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Infra-Red Photography

ONE of the most fascinating papers it has been our pleasure to hear for some time past was that on "Infra-red Photography and its Field of Application," delivered before the London Section of the Society of Chemical Industry on February 1, by Mr. E. R. Davies, the director of research of Kodak Ltd. Infra-red photography has fired the imagination of the popular Press, and Mr. Davies has collected some sparkling gems of the flights of journalistic imagination to which it gave rise. It seems strange that daily papers which habitually exercise the greatest care in gleaning news items, so frequently go astray over the significance of scientific work. They encouraged people to believe that by means of infra-red radiation we should be enabled to see through mountains and brick walls, whilst to pierce the thickest of fogs would be deemed commonplace.

How different is the truth and what are the limitations of photography by infra-red radiation, Mr. Davies was able to explain. For all wave motion, the smaller the wave-length of any radiation the more perfectly will any obstacle scatter the waves. Suspended particles of a size that will scatter light rays of the visible spectrum, which may vary from a wave-length 3,900 Å at the violet end of the spectrum to 7,600 Å at the red end, may fail to scatter the longer infra-red waves which extend from 7,600 Å upwards. Equally, when the size of the suspended particles becomes a little larger, some of the infra-red rays are scattered, and as the particle size grows, the wave-length of the radiation that is scattered becomes yet greater. Whether photographs can be taken through fog or mist depends, therefore, on the size of the liquid or solid particles. For this reason, "seeing" through a dense fog is out of the question because the individual particles are sufficiently large to scatter such infra-red radiation to which plates can be made sensitive. Similarly, when a light mist renders the distant landscape invisible to the unaided eye, it has been found possible to take infra-red photographs showing amazing clarity of detail over hundreds of miles.

Valuable as are the applications of infra-red photography in surveying, in aerial reconnaissance, in medicine, in astronomy, in botany and other fields, applications which are due to avoidance of scattering of the longer rays by the smaller particles, chemists will probably be most interested in the means whereby infra-red photography has become possible. So long ago as 1880 Abney photographed the solar spectrum to 10,000 Å, an achievement which ranked as the limit as late as 1906, but the real foundation of the art appears to have been laid further back in 1875 when Vogel first used cyanine for the purpose of sensitising the photographic plate. The cyanines have since been used almost exclusively. The effect of these compounds is complex. They consist essentially of a long chain structure of the form $C_6H_4:C_1H_2NRX.CH:CH.CH.C_4H_2NRX:C_6H_4$, where R is any alkyl radical and X is a halogen. The sensitivity of these cyanines appears to depend upon the number of carbon atoms separating the two nitrogen atoms, and higher members of the group are used in which the chains between the rings structures at the ends of the molecule may contain 3, 5, 7, 9 or even 11 carbon atoms. The higher members, the most sensitive, are highly unstable and are preserved only by being kept at low temperatures. By the use of pentacarbocyanine, the range of the infra-red available for photography has been extended to 13,000 Å.

In practice a minute amount of the dye is introduced into the photographic plate, and the amount needed may be so small as to be able to form no more than a mono-molecular layer upon the silver bromide crystals. It is known that the dye is only loosely held by the crystals because it can be washed out by solvents in the cold. These are the two established facts, and it is surprising that this very small quantity of dye, insecurely fastened to the crystal, is able to cause the decomposition of the silver salt by radiation of a longer wave-length than that to which it was originally sensitive. The effect does not appear to depend only upon the absorption of light of cerain wave-lengths since dyes of the same chemical class and possessing the same absorptive properties in the spectrum may vary greatly in their sensitising power. This action, which appears to be possessed only by one group of chemical compounds, and requires but a mono-molecular layer for its action, is surely one of the most interesting and puzzling phenomena within the range of physical chemistry.

The scientific development and the commercial exploitation of the infra-red process appear to be very recent. It was not until 1925 that the use of neocyanine enabled photographs to be taken as far as 11,634 Å, and in 1931, according to Mr. Davies, new sensitisers such as pentacarbocyanine were discovered that still further increased the range. The ordinary plate is only sensitive to about 5,000 Å, so that to extend this range to 13,000 Å has been no mean achievement. The difficulties of commercial exploitation must have been very great, and all workers, not least those of the Kodak company, are to be congratulated on a very fine achievement.

Notes and Comments

Maintenance of Chemical Plant

WHATEVER justification there may be for secrecy in chemical works practice surely does not apply to the questions of plant maintenance, yet when we were inviting contributions to the present Works Maintenance Number, we encountered the question "Why should we tell our competitors how to maintain their plant?" Such an attitude is unreasonable in the light of present knowledge. No aspect of chemical engineering to-day is more important than the question of maintenance, and the greater the opportunity for pooling information on the subject, the brighter will be the prospects for the chemical industry as a whole. Makers of plant and equipment may attain a high standard in their products, but if these products are not properly maintained, it will not be long before the profits of the user are turned into losses. Plant maintenance demands a scientific consideration of the circumstances connected with breakdowns and stoppages, wear and tear, corrosion, production costs, new processes replacing those that are obsolete, and, last but by no means least, the human factor. The special articles which we print in other pages touch only a few of the problems involved, but they serve to indicate the important part that maintenance plays in the struggle for efficiency in modern industry.

Chemical Aspects of Building Research

REMARKABLE instances of the corrosion of building structures as a result of the action of common salt are mentioned in the annual report of the Building Research Board for 1935, issued by the Department of Scientific and Industrial Research. In a margarine factory constructed of reinforced concrete, corrosion of the steel in the floor beams had taken place to an extent sufficient to burst the concrete and endanger the structure. Although it was stated that no salt was used in the rooms affected, it seemed probable that this was the cause, and a search was made for a possible source. This ended with the water used for washing the floors, which was obtained from a private artesian well. It was found that sodium chloride contained in this water was the principal factor in the failure. In another case, in which salt was found to be responsible for badly corroding electric light conduits, switches, etc., it was traced to the sand used in the plaster, which had been washed with brackish water containing salt. Sir Harry MacGowan's Messel Medal Lecture of 1934 is recalled by the statement in the report that virtually every urban authority is more or less troubled with bug infestation. It is estimated that in many areas practically all the houses are infested to a greater or less degree. Dr. R. E. Stradling, director of research, urges that the industry should try to make a contribution to the solution of this problem by preventing the formation of cracks in buildings and by producing a form of construction which, in the event of infestation, can be disinfected by the very poisonous gases at present used, without danger to the occupants of surrounding houses. The difficulties which such a solution presents are obvious, but the industry, aided, we suggest, by the chemical industry, cannot escape the responsibility of facing up to the problem.

Grants to Research Students

IN the revised "Notes on Grants to Research Workers and Students," the Advisory Council for Scientific and Industrial Research announces that it is prepared to recommend maintenance allowances for qualified students, to enable them to avail themselves of existing facilities for obtaining training in scientific research. These allowances are available only for students who have a definite intention of taking up a career in which they will devote the whole or part of their time to research work, or a career to which research is applied. A grant will also be recommended for a very limited number of senior research awards "to enable young investigators who have acquired a sound knowledge of the methods of scientific research and have shown an exceptional capacity for original thought to have an opportunity of the fullest intellectual development." Other grants to investigators which the Department of Scientific and Industrial Research is prepared to make, on the recommendation of the Advisory Council, are for fundamental research in universities and colleges. Special action is proposed in relation to research workers in metallurgy. It is thought that the development of the subject would be promoted by the introduction of men whose basic training has been in physics, chemistry or engineering. For such men some instruction in metallurgy would be an essential preliminary to research work, and the maintenance allowances will, therefore, be held available for qualified graduates in chemistry, physics and engineering, "for the purpose of a post-graduate course in metallurgy, leading to research."

Functions of a Labour Department

MOST of the larger chemical works have well-organised labour departments, but there are still many concerns in which the value of such organisation has not yet been realised. To such we would commend a perusal of the pamphlet on "The Aims and Purpose of a Labour Department," by Mr. J. H. Fullwood, president of the Institute of Labour Management—the first of a series which the Institute hopes to publish on various aspects of labour management. Labour management stands for even justice for every man and boy, woman and girl in every factory and business concern. In order to secure this there must be a labour policy with the right attitude of mind behind it: the attitude that respects the human personality with which it has to deal and behaves accordingly. This attitude must start in the board room and permeate through every section of the management down to the foreman.

The labour policy may deal with such matters as the selection, training and promotion of employees; their health, safety and working conditions, co-operation between management and operatives; the promotion of security of employment, good wages and happiness at work. Each firm must of necessity work out for itself the details of its policy according to its own requirements. But a labour policy cannot be laid down once and for all and left to itself to achieve the ends in view. It must be kept alive in the minds of the management or it will be in danger of suffocation in the hurly-burly of modern business.

Electricity in the Chemical Industry

By R. P. McCULLOCH, B.Eng., A.M.I.E.E.

THE problems facing the electrical engineer in the chemical industry are many, for not only has he to be responsible for the proper maintenance and safety of the plant, but he has, in many cases, to deal with the generation and distribution of electrical energy. One of the most disturbing problems to be faced at the moment is the rupturing capacity of switchgear. Now that switchgear manufacturers are gaining more knowledge on the behaviour of switchgear under short circuit conditions, they have been forced to de-rate switchgear which has been supplied in recent years. This fact not only calls for a large capital outlay in replacing switchgear, but may also necessitate expensive re-arrangement of the distribution system.

The reason why these problems so vitally effect the chemical industry can readily be understood. The application of electrical energy in almost every instance demands large groups of power in concentrated areas. Where a distribution system has grown from small beginnings, the transmission voltage was originally low, and on the increase of the system the voltage at which the supply is generated or received in bulk, has risen. This in turn has necessitated large transformer units of a capacity, in general, larger than those usually encountered in the electrical supply industry. The short circuit conditions on the low tension switchgear therefore may be, theoretically, anything from 50,000 to 70,000 K.V.A. The investigations which the switchgear manufacturers have so far carried out on the low tension switchgear are small, but the tendency seems to be to limit the future supply of this gear to 30,000 K.V.A.

Two Problems to be Faced

In this connection the electrical engineer is faced with two problems. Firstly, if his low tension short circuit conditions are well in excess of 30,000 K.V.A., he has to re-arrange his distribution system so that this figure is not exceeded. Secondly, it is well known that it is almost an impossibility to attain in practice the theoretical short circuit conditions, and, bearing this in mind, what allowance can be safely made between the theoretical and actual values? Normally, every case would have to be individually considered, but it seems reasonable to expect that a figure may be found which would cover the average case and which would be based on actual experience. If this could be done, much expense could be saved on low tension switchgear.

The use of electricity in the chemical industry imposes such heavy duties on each item of plant and equipment that the most stringent control has to be exercised on the point of safety. Not only has the electrical engineer to be fully aware of all statutory requirements, but it is also essential that every electrician under his control should have a proper appreciation of the more fundamental rules. Generally, the insistance that all electricians should be familiar with Home Office requirements is insufficient, because the official books convey little or nothing to him. A scheme, therefore, whereby these requirements, and also any additional requirements the engineer considers necessary, are explained simply and are fully illustrated, produces excellent results.

Portable Apparatus

An examination of the official annual report on electrical accidents will reveal the fact that portable apparatus, improperly maintained, is one of the chief causes of fatalities, and among this portable apparatus, the inspection hand lamp is most frequently used. Wherever possible, therefore, small transformers should be used to reduce the voltage on this class of apparatus. Generally, the voltages used are 15, 25 and 50 volts, and the transformers can be purchased in either the portable or fixed type. The portable type should have on its higher tension side, three core, tough rubber sheathed flexible cable provided with a standard three pin plug. On the lower voltage side should be fitted two pin plugs and sockets, and care should be taken that these plugs are non-standard and cannot therefore be plugged into any main supply sockets. The earth lead on the primary side should be connected to an earth shield between the primary and secondary windings, if an earth shield is supplied, or to an earth point on the secondary winding.

If low voltage transformers cannot be used, care should be taken in the selection of portable apparatus, and in ensuring that all metal parts of the apparatus are efficiently earthed. Furthermore, a system of routine test and supervision of all portable apparatus is essential. This job should be the responsibility of one man, or department, depending on the size of the plant. The function of this department should be the recording of the issue, return, and periodical inspection of portable appliances, and the records should be such that the location of any appliance and the results and date of the last test can be immediately available.

Further Safety Regulations

Further safety regulations should be enforced in the operation of the plant. When an electrician other than the electrician in charge is about to carry out any repair on a plant, the electrician in charge should issue a permit indicating that the particular piece of apparatus which requires attention has been disconnected and isolated from the supply. On completion of the repair, the permit is returned to the electrician in charge, who inserts it in the permit book before running the apparatus. In addition, where exposed crane wires exist, the electrician in charge should issue a permit before any man, whether electrician or otherwise, works above floor level. These regulations, in theory, may appear to be cumbersome, but in practice they have been found to work well, and when one realises how simply accidents can and do happen, they prove to be well justified.

The selection of plant and equipment has naturally to be governed by the conditions under which they have to operate. The conditions in the chemical industry may be particularly severe, and chemical dust laden atmospheres, corrosive fumes, and explosive atmospheres, have all to be catered for. Generally speaking, the standard protected type of motor is unsuitable, and the many different types of frame cooled machines have proved to be satisfactory. The external cooling fans on these machines are able to keep the cooling ribs or tubes clear in heavily dust laden atmospheres.

Contractor Gear

The increasing practice of using push button starters for motors makes the application of contactor gear difficult and costly in dangerous atmospheres. A satisfactory compromise can usually be made by having standard contactor starters mounted outside the danger area, and flameproof or explosion proof push button stations mounted on the machine. While mentioning contactor gear, it may safely be said that in any but the smallest sizes, contactor gear is not capable of satisfactorily dealing with short circuit conditions. They should be arranged, therefore, to deal only with overload conditions, and should be backed up by quick-acting, high rupturing capacity fuses.

Mainly owing to the difficulties outlined at the beginning of this article, the use of motors operating at high voltages up to 11,000 volts, is finding favour, and high tension machines of about 100 horse power and over are almost certain to become more popular in the future.

It is not possible to mention more than casually the dangers accruing from static electricity in dangerous atmospheres, and the measures necessary to eliminate and prevent static charging. Belt drives are, of course, the chief offenders in this

respect, and a good belt dressing is more effective than collector combs. Satisfactory earthing of all moving parts is essential, and it is also very necessary to measure, carefully and periodically, earth resistance. It is sometimes an exceedingly difficult proposition to obtain a good earth, and the placing of a good earth mat in what looks like suitable ground may be dangerously misleading unless it is backed up by careful tests.

In the selection of equipment such as lighting fittings, inspection lamps, plugs and sockets, distribution boards, small cables, conduit and conduit fittings, etc., standardisation can play a useful part, and especially so where the control of factories in different parts of the country is concerned. The critics of standardisation maintain that it is difficult to keep standards up to date, but one will find that the development of the equipment outlined which is really useful for industrial purposes, is slow.

In the case of plugs and sockets, various pin centres are still being marketed, although they are covered by a British Standard Specification, and where much portable apparatus is used it can be a source of great inconvenience to find plugs and sockets non-interchangeable. Flame-proof lighting fittings play an important part in the chemical industry, and it is interesting to note that, so far, the Buxton Certificates issued in connection with these fittings, do not cover the full range of explosive mixtures encountered in the chemical industry. A move, however, is on foot to fill this gap. A simple and common piece of apparatus like the standard lamp-holder can be troublesome in some atmospheres, and the moulded lamp-holder especially so. These troubles can usually be overcome by using a moulded lamp-holder having a steatite interior, and, incidentally, this type of lamp-holder is being recommended by some big supply authorities for normal domestic use.

The Maintenance of Autoclaves

By V. A. YARDLEY

THE operating conditions of autoclaves in industry cover a very wide range; pressures may vary from a few pounds to many hundreds per square inch, and temperatures may reach 300° C. Moreover, chemical attack may present extremely diverse corrosion problems. In order that running and maintenance costs, which are largely governed by the initial design, may be kept down, it is necessary that the plant should be easy to dismantle, be provided with proper means for removing heavy parts and possess adequate room for working without causing any interference with the running of the neighbouring plant. This will be most important where conditions of service are likely to be severe as is the case with autoclaves and other high pressure chemical plant. It should be appreciated also that maintenance costs are closely related to the value of the plant installed.

Excessive Linings

Most autoclaves are constructed of steel and, if required, are lined with materials, chosen as far as possible for their resistance to chemical attack, such as aluminium, copper, lead, nickel and its various alloys, glass and enamel. The use of such linings is in general expensive and where the pressures and temperatures in the autoclave are relatively low such plant is often constructed solely from the above metals.

This principle applies also to the various parts such as the agitator, thermometer pocket, pressure gauge fittings, dip-pipes, manhole and filling covers, and the various cocks and valves.

It will be manifest therefore, that autoclave plant is more expensive to make than ordinary chemical plant mainly because of the cost of the special materials used, the particular methods of fabrication employed and the better class of workmanship required for its construction.

For these same reasons upkeep charges will be at a much higher rate than they will be for ordinary chemical plant and if long life with minimum maintenance costs are to be envisaged then due attention must be paid to reducing the wear and tear of the plant.

Duties of Process and Maintenance Staffs

This can be effected by ensuring definite and proper methods of operating the plant and by defining the responsibilities and duties of the process and maintenance staff. It is suggested therefore that process staff should regulate, but not repair, and that the maintenance of autoclaves be undertaken by the mechanical staff. In the ordinary type of chemical plant it is often possible and sometimes more convenient for a process operative to do his own servicing, but with plant so specialised as autoclaves it is better that the servicing should be done by staff more highly skilled in such work. This argument may be illustrated by reference to the adjustment of the agitator packing gland. The surface of a rotating shaft is very liable to damage and mal-adjustment of the gland may therefore result, not only in damage to the shaft, but also to the loss of a batch through enforced shutting down.

In the routine maintenance of autoclaves great care is essential in the choice of the packing for the gland of the agitator shaft. Coarse or harsh packing is undesirable and flaked graphite greases should be used with caution, as the edges of the graphite flakes are sharp and hard and may quickly spoil the surface of the shaft. Particularly suitable are the various flexible white metal packings and those which consist of a series of white metal and leather rings, especially if arranged to be lubricated by oil under balanced pressure.

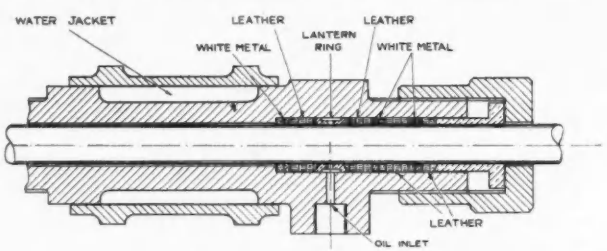


Fig. 1. Detail of Stirrer Gland.

For the leather packing, ordinary scrap leather belting soaked in tallow may be used and the arrangement shown in Fig. 1 has been very successful on autoclaves working at 250 atmospheres pressure at temperatures up to 400° C. Packings should not be permitted to become hard and should be renewed frequently in order to forestall gland failure. It is also a good practice to fit an adjustable hood on the shaft, immediately above the gland in order to prevent dirt or chemical materials from entering the gland and so damaging the shaft. For filling, washing and blowing-over operations, plug-cocks are better than globe or gate valves, as they provide free flow for the liquid whilst their working faces are protected from erosion. The older type of plug-cock is liable to stick and the usual remedy of hammering is always a dangerous practice. The newer types of lubricated and sleeve-packed cocks have overcome these difficulties and since they are made in a variety of materials and are designed for all pressures, their use on autoclaves is to be recommended.

For regulation of pressure and flow however, other types of control are more suitable. The ordinary conical seated valve does not lend itself to economical service, for when par-

tially opened and the fluid velocity is high, erosion of the valve and seating takes place. For such purposes the piston-type valve, although subject to erosion trouble, gives much longer service, providing any incipient leaks are skilfully remedied.

In high pressure valves, trouble with gland packing is often noticeable, due usually to slight corrosion of the valve stem. This can be avoided if a spindle of non-corrosive alloy is used such as monel-metal or austenitic steel.

The covers and other fittings attached to an autoclave are best connected by flanged joints generally of the spigot and recess type. Such joints give satisfactory service if, when remaking the connection, precautions are taken to ensure that the joint faces and the gasket are clean. This is particularly important when metal gaskets are employed.

Copper is often used as a jointing material and with care such a gasket can be used many times before renewal, but it must be borne in mind that the copper work-hardens during compression and so it is preferable to anneal the gasket before remaking the joint.

For service on autoclaves only those pressure gauges should be used which are fitted with steel Bourdon tubes, since those of bronze are in many cases inadmissible, for example, when ammonia is present. It is advisable to ensure that all persons on the plant are aware of this, because although it may seem an elementary precaution, such things can easily be overlooked in the hurry of replacing a faulty gauge.

Autoclave linings can be easily spoiled and when the effect of a new method of processing is in doubt, it is better, first of all, to have a trial run in a laboratory autoclave. An example of this may be given in the amination of organic compounds by the use of ammonium chloride. The lining has to withstand not merely the action of the ammonium chloride and the organic materials, but also the hydrochloric acid formed by thermal dissociation of the ammonium chloride. At temperatures in the region of 320° C. the pressure will be about 60 atmospheres if a silver lining be employed, but when an 18/8 type steel is used as the lining it is attacked by the liberated acid and the pressure may rise to over 100 atmospheres due to evolution of hydrogen.

Where prevention of corrosion is not practicable the lining may in certain cases be preserved by a judicious selection of materials for the other parts of the autoclave, whereby attack

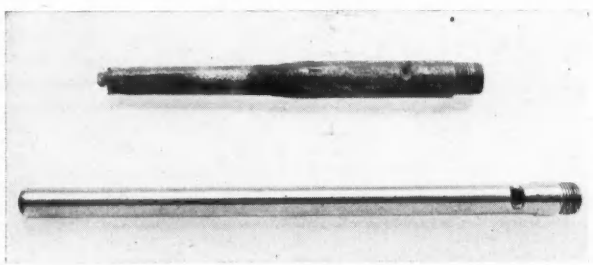


Fig. 2. New and corroded protective housings for thermometer pockets.

may be diverted to those parts easily renewable such as the blades of an agitator or the protective housing for a thermometer pocket, such portions being more heavily built to allow for this wastage. Fig. 2 shows the effect of selective attack on the covering for a thermometer pocket after twelve hours in contact with ferric chloride and an organic compound. In this instance the lining and stirrer were of 18/8 type steel and the corroded fitting of ordinary steel. The chemical works regulations require that autoclaves should be fitted with a safety valve or other equally efficient means of releasing abnormal pressures. Unhappily, the safety valve is always a potential source of danger, which its substitution by a bursting disc does not entirely eliminate, since both valve and disc can become easily choked with material and so fail to operate. The fact that it is seldom necessary for such reliefs to function, gives a false sense of security and in all cases where choking is possible, such reliefs should be dismantled and cleaned at regular intervals, if need be at the end of each run. To facilitate such cleaning, safety valves should be of robust construction and capable of being readily dismantled without disturbing the valve setting. It is not possible always to keep fully occupied every autoclave in a works, and when laying off an autoclave, it is a good policy to make sure that, after the usual cleaning and washing out, the autoclave is kept as dry as possible, for example,

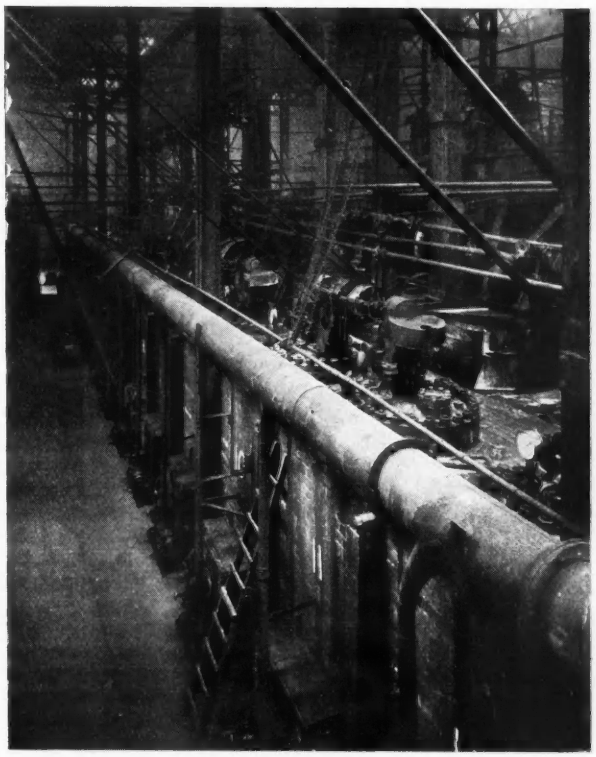


Fig. 3. A battery of gas-fired high pressure autoclaves for the production of general intermediates in dye manufacture. (Published by kind permission of L. B. Holliday and Co., Deighton, Huddersfield.)

by placing a tray of quicklime inside. It is desirable also to remove the packing from the agitator stuffing box and refill it with grease. This practice will avoid the troubles consequent upon the employment of aged packings, which are frequently overlooked in the hurry with which such plant is brought back into service.

In view of the fact that autoclaves have to withstand high pressures and are subject to deterioration it is essential that all possible steps should be taken to ensure safety in operation. This can be secured best by periodic examination, which should include visual inspection, observations of any change in structural dimensions and an hydraulic test to the maximum pressure for which the plant was designed. The results of these examinations should be recorded in the log-book which should be used for recording all details of maintenance, arranged in sequence with the process-log, so that the full history of the plant is available.

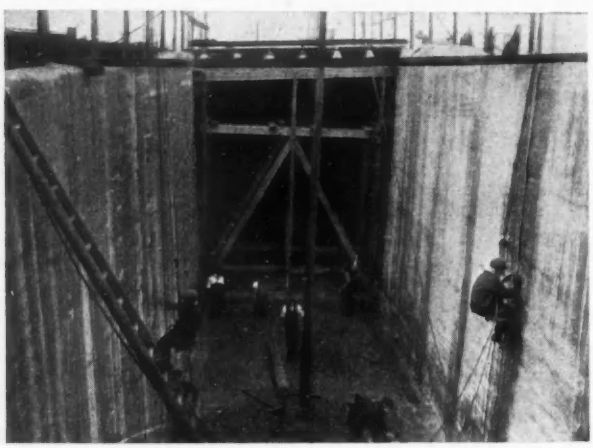
DR. FOSTER DEE SNELL resigned the hon. secretaryship of the American Section of the Society of Chemical Industry at the Perkin Medal meeting held at the Chemists' Club, New York, last month. Dr. Snell has ably performed his duties for over 10 years and was secretary at the time when the Society visited the United States in 1928 to hold its annual meeting. Mr. Cyril S. Kimball has been elected to succeed him.

Maintenance Problems of Calcium Superphosphate and Sulphuric Acid Plants

By P. PARRISH, F.I.C., M.I.Chem.E., M.I.Gas.E.

THESE are the days of budgetary and higher control. Under such systems, profits, or sales (which are tantamount to profits), have to be forecast with accuracy, and working costs, involving maintenance of plant, and many other items, have to accord strictly with the forecast. In other words, there must be scientific management of processes which are in themselves technical in character. No process, however, can be managed scientifically unless there is satisfactory maintenance of the plant. Efficient maintenance of chemical plant connotes maximum production, at the highest efficiency. The maintenance of chemical plant calls for the exercise of foresight, and the steps taken to ensure such maintenance must necessarily vary with the nature of the product manufactured.

Some chemical plants manufacture products such as fertilisers, which are required for seasonal demand: others manufacture products which are in regular demand. Where the products are manufactured for seasonal demand, certain weeks of the "off-season" can be assigned for general repairs and maintenance work. Thus, it is usual to give attention to all the mechanical equipment, such as grinding units, elevators and conveyors, bagging and loading equipment, at a superphosphate works at certain weeks in the summer. But at the works were scientific management is attempted, a programme of repairs and renewals will have been prepared six or twelve months ahead, and an estimate given of the cost involved for labour and equipment. Generally speaking, the previous year's figures afford a guide, and may need to be modified according to the extent to which renewals or heavy repairs are called for, or the extent to which the magnitude of operations has expanded. In any case, it is futile to work in these matters "in the dark": therein lies disaster.



Construction of and with lead burning in connection with a new sulphuric acid chamber.

A works engineer should know when the chains of an elevator will need to be renewed: when the skidder bars require to be replaced: when the clutches will need to be re-bushed, and when the grinding rolls require bushing and providing with new bearings. It is preferable to use manganese steel for the rings and rolls.

Log books should be kept, which give the dates of the purchase of these several accessories, running repairs that have been necessary, and the steps, if any, which have been taken to ensure better service. It is surprising how the life of such things as elevator chains and buckets, the grinding rolls and bagging machinery, can be increased when a proper system of examination has been organised. How often is there a stoppage here, and a hitch there, because there is no organised system of examination or of foolproof lubrication of the moving parts! Forced-feed lubricators should be provided where necessary, operated by either mechanical or hydraulic means. But there may be certain bearings in all factories which are more or less inaccessible, which do not admit of forced-feed lubrication, and these must have individual attention.

Homogeneous Lead Linings

The avoidance of dust at superphosphate works is essential for the best life of the chemical plant. The dust of Florida Rock and Kola phosphates is hard and gritty, and if it is allowed to reach moving parts and bearings, it is bound to cause wear and tear. The paper recently given by Mr Walter Packard, to the Institution of Chemical Engineers, made clear how the superphosphate industry has become mechanised, and how in a modern factory there is not a shovel or a barrow used from the time the phosphate enters until the superphosphate leaves the works.

Where the Oberphos process has been adopted, and reaction of the ground phosphate rock and sulphuric acid is effected in an autoclave, another complication is added. The autoclave is a homogeneously lead-lined vessel, steam jacketed, weighing over 40 tons; the control valves are made of acid-resisting metal and are expensive.

The homogeneous lead-lining must be undertaken with meticulous care, working from lead strips of unquestioned purity, which are free from any vestige of lead oxide, otherwise microscopic pinholes will be present, which will lead to the sulphuric acid reaching the metal to which the homogeneous lead-lining has been attached. Nothing is worse, for such homogeneous lead-lining, than working alternately under a pressure of, say, 80-90 lb., and suddenly under a vacuum for another period. The homogeneous lead-lining is put to a severe test, and defects will soon reveal themselves if the slightest flaw exists. If acid reaches the cast iron, then iron sulphate is formed, and the force it exerts under developing corrosion is such as to create "carbuncles," which soon fracture and involve the destruction of the lining, the renewal of which must be expensive.

Systematic Maintenance

There can be no doubt that these newer processes and increasing mechanisation bring in their wake new problems affecting general maintenance of plant, which call for skill, foresight and initiative, and afford an opportunity for the chemical engineer to reveal his intrinsic worth.

Where a sulphuric acid plant operates in conjunction with a calcium superphosphate plant, generally speaking there is more opportunity for conducting a scheme of systematic maintenance than is the case with a sulphuric acid plant which is called upon to supply a regular demand. This is unquestionably the case where a chemical manufacturer has "placed all his eggs in one basket," in the shape of a single large unit. Where two smaller units are available, one can generally be put out of commission for a week or two, to admit of repairs to the brickwork of the hearths, or the central shaft or arms of the mechanical pyrites burners, or to allow of attention to the electrostatic dust chamber, the tubes or electrodes of which may require attention.

It is a different problem at the works where no second unit is available. Such unit of plant has to be maintained at a high standard, and all the resources of the chemical engineer may be fully taxed, in ensuring the double objective of a

well-maintained plant, and continuous maximum production. Sooner or later the plant must shut down, say, for the renewal of a burner pipe (the connecting pipe between the stalk and the Glover tower), or for repairs to inaccessible parts, incapable of being dealt with satisfactorily during the time that the plant is in operation.

One of the most vulnerable parts of a sulphuric acid plant is the burner pipe: the degree of vulnerability depends on several factors, such as (a) the temperature attained in it, (b) its construction, and (c) the nature of the gases with which it is called upon to deal. How often does one see the collar joint leaking after operation for a year or eighteen months! Water-cooled collars are recommended, where unusually high temperatures have to be legislated for.

When the American Institute of Chemical Engineers visited this country last summer, the writer was informed by one of the members that some of their sulphuric acid units (nitration process) had been in operation for seven years. Knowing what happens to the collars and burner pipes in this country, one wonders whether the inspection of sulphuric acid factories in America is as systematic and thorough as under the Alkali Works Regulation Act in this country.

The Chief Alkali Inspector (Mr. W. A. Damon) was associated with the writer for many years, and there is not much about the finer or more delicate points of heavy chemical plants and processes with which he is not familiar. Little wonder that his inspection has developed into a religion, that he is an ardent advocate of improved maintenance of chemical plants, and is particularly concerned with anything that has relation to a purer atmosphere!

A Useful Acid Resisting Cement

An acid and heat-resisting cement of great utility, and of the first importance in the repair of a burner pipe, or the hearths of pyrites furnaces, or indeed the special tiled hearths of hand-operated spent oxide burners, is Hysilyn "A." A hole in a hearth can be readily and effectively staunched by smearing a piece of coke with plastic Hysilyn "A," and forcing the coke in the hole, and pointing vigorously the accompanying cement firmly and securely around the affected part. What happens is that the coke is eventually consumed, and the plastic cement knits into the adjacent brickwork or tiles, and forms a homogeneous mass indiscernible from the other brickwork or tiles.

Problems affecting maintenance of a sulphuric acid plant are the life of the Glover and Gay Lussac towers and their lining and packing materials. The method of working the towers, the character of the acid and heat-resisting materials of which they are built, uniformities of feed and a host of other factors, have an important bearing, and render it difficult for one to be dogmatic.

Repairs Whilst in Operation

It is surprising what can be achieved by an efficient chemical plumber in the shape of repairs to the lead chambers and Glover and Gay Lussac towers. Leaks in the bottom of the chamber, if not too far removed from the skirting, can be repaired effectively while the plant is in operation, if a little resource is exercised. Crowns can be renewed, and skirting and dishes repaired, or indeed renewed, during the time that the plant is operating, if circumstances demand. But where the chemical sheet lead is suspended in a scientific way, repairs of the sulphuric acid chambers should not be necessary for several years. At large works, as many as five to ten units of sulphuric acid plant may exist. These will be of different ages, and the necessity for repairs and general maintenance work is ever present.

The accompanying illustration shows the renewal of a chamber proceeding apace. Two of the plumbers are busy with vertical burning of the side sheets from boatswains' chairs, during the time that a further set of men are fixing the top sheets. With an efficient and well-organised team, it is possible to renew a series of chambers in a month or six weeks. But under these conditions, there must be foresight and vigilance: all the materials must be on the job, including derricks, blocks, tackle, jib cranes, compressed air-operated winches, and what is more, there must be due regard for safety first. When it is remembered that all the foregoing aspects have to be co-ordinated, and the work undertaken for a pecuniary sum already fixed and budgeted for, one begins to realise that the problems of the chemical engineer are exacting.

The Maintenance of Efficiency in Filters

By J. A. PICKARD, A.R.C.Sc., B.Sc., F.I.C.

IN practically all commercial filtration problems we are concerned with the removal of solids from liquids, though the removal of emulsified matter is undertaken occasionally by filtration. It is well to bear in mind, before considering the efficiency of a filter at all as such, that filtration is one of the more expensive and laborious ways of accomplishing the desired end; which, very often, can be more conveniently and much more cheaply attained by other means, *e.g.*, by settling—although probably at the cost of some increased expenditure of time. If it is decided, taking all considerations into account, that filtering is the best way of obtaining the desired separation, the work required from the filter may be made very much lighter and less exacting in a large number of cases by taking thought beforehand in the preparation of the prefilt.

Preparation of Prefilt

The rapidity and ease of filtration is intimately connected with the size and shape and hardness of the suspended particles of solid in the prefilt, and where these arise as the result of a chemical reaction or precipitation they may often be modified, favourably to the filter, very considerably in manufacture, without in any way prejudicing the quality of the product. A familiar instance is the precipitation of barium sulphate, which, produced from cold strong solutions, is almost unfilterable, while from hot liquids when one is added slowly to the other a crystalline precipitate falls down which can be filtered almost as easily as sand. Coagulation and agglomeration of precipitates already formed can be promoted by various devices of which prolonged settling in warm conditions, and sometimes violent agitation, are examples. Coagulation by the introduction of further material, such as hydrate of alumina or traces of paper pulp may also be well repaid.

The maintenance of all round efficiency depends mainly upon (1) the maintenance of the porosity of the filtering medium; (2) maintenance of the efficiency of the pumping arrangements; and (3) the avoidance of corrosion or chemical attack. Woven textile materials, such as filter cloth made from cotton, wool, or asbestos, are the most widely employed filtering media used in industry. Their useful life in service may be greatly extended by careful attention to detail in their treatment. With filter cloths—at all events where fine precipitates are in question—it is often the case that the first runnings are slightly turbid, while the main bulk of filtrate thereafter is quite bright. This arises from the interpenetration of the cloth by the solid particles, which soon obstruct the tortuous internal passages and prevent further suspended solids from going through.

At a second filteration, when the filter cake has simply been attached and the cloths replaced on the frames, the interior

of the cloth will not have been very much affected, but such movement as there has been will have tended to loosen the retained particles, so that, when filtration recommences they tend to be carried farther along with the new filtrate. On this account, maintenance of porosity is connected with the thickness of the cloth used. If a very thin cloth is used the disturbed particles may be carried right through the cloth at the second filtration and turbid filtrate accordingly produced again until the initial cake has built up. Where a very thick cloth is employed the disturbed particles are carried farther into the cloth, but not right through it, so that, at the second filtration, a greater depth of clogged cloth underlies the cake than at the first filtration. With a thinner cloth, at the second filtration the loosened material previously caught in the cloth is partly carried through into the filtrate, and the back pressure of the cloth when clear filtration begins is little if any greater than before. The same effects are produced in subsequent filtrations, so that it can be seen that a thick cloth tends to block up and produce a back-pressure hindering filtration much more than a thin or medium cloth.

Filter cloths are damaged in washing and replacing much more than in actual use, and careful attention while introducing them into the washing machine and during removal therefrom will be well repaid. During the actual washing process it is advisable not to use high temperatures, such as direct steam, as these have a very prejudicial effect on the strength, especially if strong detergents or alkalies are employed at the same time. The cloths should be rinsed well and not allowed to dry, as several undesirable influences are avoided by keeping the cloths wet, and preferably submerged. The growth of moulds is avoided thereby, and this is very liable to occur where organic or food products have been handled and the poorly rinsed cloths are left about in a half dry state. Further, drying results in the concentration of any dissolved solids in the absorbed wash water, so that strong local concentrations may result with damage to the fibres.

Filter Pulp

Maintenance of filter pulp in good condition is a job requiring great care and attention, and close observance of conditions. This material after use is usually in the form of thick soft slabs coated externally in the majority of cases with a thin film of slimy material such as yeast or protein. If this can be scraped off to any degree any trouble employed here is well expended, but generally the cakes are simply roughly broken up in the state in which they come to hand and cleaned in a beater. Water is continually passed through, removing the soluble matter. The water may be either hot or cold. If cold it is necessary to use alkali or something similar to remove the clogging material, and is this is done it is highly important to wash particularly well, as there is a marked tendency for the cotton fibres to retain salts on their surfaces, and these may later affect very unfavourably any food products which have to be filtered. With cold water there is, at any rate, no need to watch the temperature carefully, but this is highly important with warm washing. In the first place the temperature must not be too high, as many of the protein materials filtered out are soluble in warm water, but are coagulated at high temperatures and cannot then be removed; and, in the next place, very high temperatures produce a sliminess in the material which is highly unwelcome, and prejudicial to its filtering behaviour. When the cakes have to be recompressed care should be taken that the filter mass is even, containing no undisintegrated lumps, and attention should be paid to getting the compression fully adequate round those parts of the cakes which have to take the greatest strain, *e.g.*, round the centres of the cakes in the Goldman double cell filters.

The stream-line filter depends for its efficiency on edge filtration. The solids do not enter into the bulk of the filtering medium, as is the case with cloth and pulp filters, consequently the accumulated solids can be efficiently and completely got rid of by a reverse flow of air through the filters. In the most widespread application of this filter—to the reconditioning of used lubricating oils—the filtering rate is very materially slowed done at the end of an 8-hours run as a result of the solid deposit, but reversal of flow with compressed air, taking only a minute or two, restores it to normal. Even when dealing with very dirty oil drawn from the sumps of diesel engines in some cases it is possible to maintain a pack in efficient service for seven or eight years, but typical cases show a life of about 28 months. With insulating oils the life is even longer and five years is by no means an unusual period without dismounting or renewal.

Important points in using stream-line filter packs are to keep them free from moisture and from overheating, and the end compression must be properly maintained. If these points are well attended to packs can be kept in use which have been subjected even to the unfair duty of having to remove gummy deposits, as it is possible to restore the rate again by scraping the outer surface lightly with a knife.

With porous stone filters the maintenance of porosity is even more important than in the case of filter cloth as it is almost impossible to remove by mechanical means solids lodged within the pores. It is advisable with such filters to carry out an initial filtration on coarse material, as by this means the exceptionally wide pores are obstructed nearer to their outward ends, and the fine portions of precipitate do not penetrate so far into the mass; with the result that the main body of the filter medium remains clear and with but a slight back pressure very much longer than would otherwise be the case. The restoration of porosity can, practically speaking, only be accomplished by chemical means, such as washing with acid, or other solvent of the choking material. Air and steam are not usually very effective.

Metafilters

Metafilters are filters which rely for their action on filtering through a bed of powdery filtering medium laid down as a coherent mass on a substructure which is generally built up from metals rings assembled on a drainage rod. In this case no question arises as to the maintenance of the porosity of the filtering medium, since it is renewed for each operation, but the substructure of rings must not be permitted to become clogged. To avoid this the filter bed should be laid down on the surface after suspension in a clean liquid. In this way nothing can get into the small crevices between the rings except filter medium itself, which cannot block them up as fine or gummy precipitates could. Corrosion of the surfaces of the metal rings themselves must be carefully avoided, and this point will usually have been attended to by the manufacturers by selecting suitable metal for the construction. Corrosion is promoted by leaving the filter in a half dry state, which should never be permitted. Maintain the filter full of liquid—this will not only prevent corrosion, but will also prevent particles sticking to the metal after drying, and give no opportunity for crystalline deposits to cover the surface.

Silver Plating

Plating with silver is a very much better precaution and is by no means prohibitively expensive. Small and awkward interior parts, such as pipes and elbows, can be plated in silver with the greatest ease by small portable plating sets.

Leaky valves and cocks are a source of frequent losses, and in many cases the more elaborate lubricated types are inadmissible, so that straight-through plug cocks have to be used. If it can be arranged for these always to be turned in the same direction—*e.g.*, clockwise—instead of backwards and forwards the preservation of the seating is greatly prolonged and frequent regrinding avoided. It would take too long to give an account of all the accidents and deficiencies of adjustment which can happen to pumps, and here it can only be said that for filter work it is often the simplest and heaviest types of pump which give the best results. Plunger pumps, either belt or steam driven, usually have very long lives and are relatively easy to keep in order. They are, however, bulky and expensive, and much smaller pumps, e.g., varieties of gear pumps will do the same work for a lower initial outlay.

Economic Maintenance of Pumps

By BRIAN N. REAVELL

THERE are many types of pumps in use to-day which may be classified into three main divisions: (1) centrifugal; (2) reciprocating; and (3) rotary positive displacement, whilst there are some special designs which fall under more than one of the divisions. Very serious trouble may be experienced with pumps, caused by corrosion of the working parts coming in contact with the liquid being handled unless the material of which the pump is constructed are reasonably resistant to chemical attack by the liquid being handled. Whilst it is not always possible to obtain a pump for a particular purpose made of materials absolutely resistant to corrosion, manufacturers have at their command such a wide range of metals, plastics, and ceramics, that almost any liquid can be handled without corrosion of the pump becoming a serious item of maintenance.

Regular Inspection is Essential

When a pump has been installed, regular inspection is essential in keeping maintenance costs down to a minimum, and the examination of the pump should be done to a regular schedule. The most satisfactory method is to keep a "Maintenance log sheet" for all pumps, and the engineer in charge should have these logs filled in regularly at each examination. The following specimen log sheet shows how the points for attention may be conveniently tabulated:

PUMP MAINTENANCE LOG.
Make of Pump — Smith & Co. Ltd.
Size and Type — 2in. Centrifugal
Date Installed — 3/1/35

RESULT OF EXAMINATION.

Date of Examination	Impeller	Shaft	Bearings	Gland Stuffing Box	Drives	General
26-3-36 ..	No wear	Slight wear	Good	Renew Packing	Belts Slack	Should fit new belt, otherwise O.K.
Etc.						
Etc.						

If systematic examinations are recorded in this way trouble will be forestalled and the life of the pump increased. It may be asked how frequently such an examination would be necessary, but as this will depend entirely on the design of pump and nature of liquid being handled, it is not possible to stipulate a period that will apply to every condition. However, for most purposes the gland stuffing box should be examined and adjusted at least once a week, and the whole pump dismantled not less than every six months. The best way to decide these periods is to make rather frequent examination to begin with, and from the conditions of parts, decide a schedule for future.

The best way of adjusting the gland and stuffing box of an ordinary centrifugal or rotary pump is to tighten up the gland fairly hard with the pump stationary and then slacken it back a little until it turns freely. The pump should then be started up and run for a time to ascertain that there is no excessive leakage, making further adjustment with the pump stopped if this is required. If a gland is adjusted in this way it avoids over-tightening which may easily score the shaft in a short time.

When examining a gland, attention should be paid to the condition of the packing, and if this has become very hard,

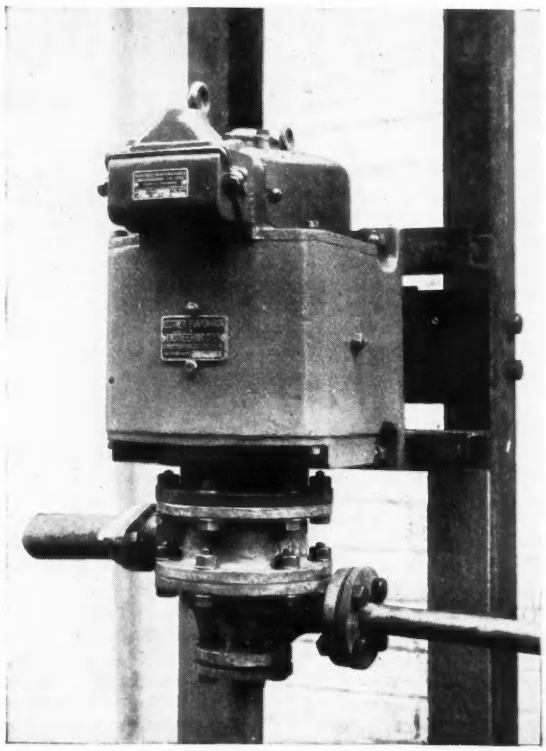


Fig. 1. Vertical glandless Centrifugal Pump direct coupled to driving motor.

it should be completely renewed. Unsuitable packing may cause a lot of trouble not only by allowing excessive leakage, but also by scoring the shaft.

The earliest types of acid pumps both plunger and centrifugal were fitted with ordinary glands and stuffing boxes, and no particular attention was given to their design by manufacturers. It was, however, soon realised that the gland and stuffing box was the most troublesome part of the pump, and many ingenious forms of improvement have been devised from time to time both for Centrifugal, Reciprocating, and Rotary pumps. But there is no doubt that the complete elimination of the stuffing box has been the only really satisfactory way of preventing the continual maintenance which this part usually requires, and there are a number of makers who supply "glandless" pumps for practically all purposes either contrifugal or reciprocating.

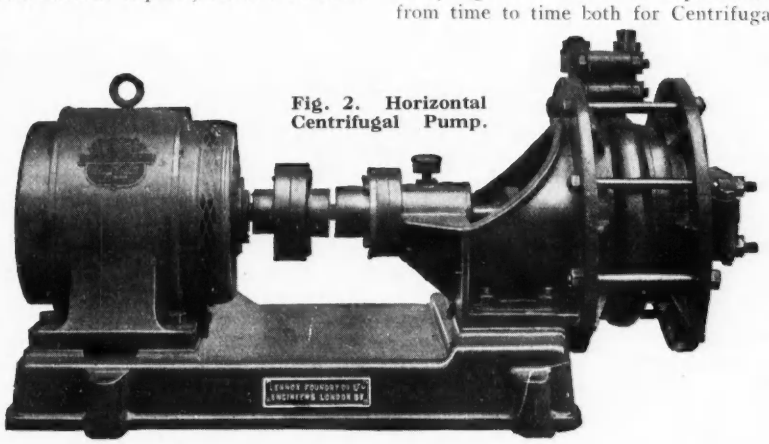


Fig. 2. Horizontal Centrifugal Pump.

A good example of up-to-date practice in glandless pump design is shown in Fig. 1 which illustrates a vertical glandless centrifugal pump directly coupled to the driving motor. The design of gland in this pump whereby no form of packing material at all is used, and in which the rotating parts do not have any bearing surface with the stationery parts inside the pump, greatly reduces the cost of upkeep.

Whilst the absence of a stuffing box is an outstanding advantage, it is not always practicable to use such a pump, and the more orthodox type of pump fitted with glands have been greatly improved by careful design, and the maintenance cost usually attributed to this point is not so serious as it once was. Fig. 2 illustrates a design of horizontal centrifugal pump in which particular attention has been paid to the size and shape of the stuffing box, and maintenance of this part is reduced to a minimum.

Controlled Leakage

A reciprocating or plunger pump can be obtained in which the normal stuffing box is dispensed with and a controlled leakage is allowed to take place between the plunger and cylinder wall. The rate of leakage is very small and is returned continuously to the feed tank. Reciprocating pumps of this sort require very little maintenance. If a pump is neglected, particularly one handling corrosive liquid, and the gland allowed to leak, there is a risk of the liquid splashing on to the spindle and external parts of the pump, causing rapid corrosion, and the necessity for replacing the parts, which can be avoided by regular adjustment of the gland. For the same reason it is essential to maintain all joints in the pump casing and all connecting pipes in perfect condition to prevent leakage and the damage caused by external corrosion.

It is generally found that the parts requiring renewal most frequently in a centrifugal pump, are the shaft and impeller, and that most rapid wear takes place between the shaft and the neck ring of the gland where a certain amount of rubbing takes place, which accelerates the corrosive action of the liquid. If this is allowed to develop, serious wear will take place and it may be necessary to replace not only the shaft, but the gland neck ring as well, and to avoid this, the shaft should be replaced as soon as appreciable wear is in evidence.

The impeller of a centrifugal pump is most subject to wear on the periphery owing to the high velocity of the liquid passing through the veins. If the impeller is allowed to wear badly it will run out of balance and cause an excessive load on the pump bearings, and may eventually bend the shaft. To prevent this happening a new impeller should be fitted before the wear is serious, or in the case of lead pumps it may be possible to build up the metal and put it back in balance.

In the case of plunger pumps the life of the piston or piston rod can be shortened very quicky if the gland stuffing box is carelessly adjusted, and this should always be kept as loose as possible consistent with satisfactory sealing.

Lubrication Prolems

Any type of pump which utilises valves should receive regular attention to prevent the seatings becoming worn, and it is usually possible to re-grind a valve and seat quite successfully as soon as signs of wear are in evidence. If, however, these parts are neglected the faces of both valve and seat may become so severely pitted that grinding is impossible and the parts will have to be replaced.

The lubrication of pump shafts and bearings must be carried out at regular intervals to ensure long life, and this is particularly important with some high speed rotary positive displacement pumps. The correct grade of oil or grease should always be ascertained from the pump maker, and every care taken to see that only the recommended grade is being used by the men in charge of the machine.

Many pumps are fitted with plain bearings with ring oilers, and it is always advisable to wash out the oil sumps of such bearings with paraffin and refill with fresh oil at regular intervals, especially when the machine is working in a dusty atmosphere as dust tends to work into the oil sump and thicken the oil, and eventually forms a thick sludge which prevents the ring turning, causing the bearing to run dry.

Attention should be given to the method of drive which is adopted for a pump, and where the design of pump and arrangement permits, it is preferable to utilise a direct coupled electric motor. There are, however, many cases where this is not possible, and if this is so, the pump should be driven by means of V belts in preference to the ordinary flat belt drive. V-belt drives can be arranged with very close centres between the motor and pump, and they can be effectively enclosed against dust and fumes and require very little attention, whereas a flat belt drive requires longer centres between drives and more frequent adjustment to prevent belt slip and wear.

Careless installation and neglect in operation are the two chief causes of pump failures, but if proper attention is paid to these points, the user should find maintenance costs a very small item.

Optical Lenses from Plastics

New British Invention

As a result of research, an entirely new method has been invented for the production of optical systems (lenses) from plastic materials. This invention, which is all-British, is likely to exercise a revolutionary influence on the optical industry. Using specially designed moulding machines it is possible to produce lenses already polished and ready for mounting into cameras, binoculars, spectacles, and all scientific instruments with an optical system. The lenses are made by special treatment for their particular purposes from various plastic and transparent materials. They are unbreakable, half the weight of glass, and have certain optical properties which are stated to be superior to glass. One of the plastics used in the process is known as " Perspex," a material recently developed by Imperial Chemical Industries, Ltd.

As explained at a demonstration held at the Waldorf Hotel, London, on February 9, this new method of manufacture obviates all the long and expensive grinding and polishing processes in the hands of highly skilled labour which are at present necessary in the manufacture of optical systems. The new lenses will be exhibited to the public for the first time at the forthcoming British Industries Fair.

Chemical Matters in Parliament

Calcium Carbide

In the House of Commons on February 3, Mr. T. M. Sexton (Barnard Castle) asked the Minister for the Co-ordination of Defence whether the question of the establishment of a factory for the manufacture of calcium carbide in South-West Durham would be kept in mind, considering that abundance of first-class limestone and coal were in close proximity, while electric power was at hand, and unemployment was rife among the quarrymen and coal miners of that district.

The Minister for the Co-ordination of Defence (Sir Thomas Inskip) replied that the supply of calcium carbide was under consideration, and he regretted he could give no information at present. The member might rest assured that the claims of South-West Durham, together with those of other areas, would receive full consideration.

On February 4, Mr. A. Short (Doncaster) asked the Minister of Health whether he had taken any steps under the Public Health Acts to ensure that in the construction of new factories provision was made for all trade effluents to pass into the local sewage system and thereby obviate the continued pollution of our streams and rivers.

Sir K. Wood replied in the negative. The Public Health Acts did not empower him to take action of this kind, but he proposed shortly to introduce a Bill to facilitate arrangements for the reception of trade effluents into sewers.

Economy in the Maintenance of Steam Generation Plant

By DAVID BROWNLIE

ALTHOUGH most attention has been concentrated upon direct fuel saving in steam boiler plant in the sense of operating at the highest thermal efficiency using the cheapest coal or other material available, considerable economies are also to be obtained by reducing the maintenance costs to a minimum. Savings in this connection consist not only in actual reduction of the average upkeep and repair costs per annum, but also less expenditure on fuel in the sense that modern methods as regards attention to maintenance mean higher thermal efficiency.

Unequal Expansion at Contraction

Boilers in the chemical and allied industries are largely of the cylindrical type, but water-tube boilers are coming more and more into use, and consequently adequate consideration of maintenance economy must cover both general types, and especially in view of the gradual increase in industrial steam pressure. First, it is essential that boiler plants should be protected from the open air so as to reduce troubles caused by unequal expansion and contraction. Admittedly a chemical works has long since ceased to be in the same category as a large proportion of mines, with the boiler plant run, in extraordinary fashion, without roof or cover of any kind. Curiously enough, however, one of the latest developments in the United States is the operation of high pressure steam power plant in the open air to avoid the cost of buildings, although needless to state with very special methods of heat insulation. In a large proportion of chemical works, as in other industrial establishments, the boiler house, although provided with a roof, is still fully open at the front and sometimes at the sides, and the remedy to adopt is obvious.

It is also essential that the brickwork of boilers, as well as of economisers, should be kept absolutely air and gas-tight, with periodical examination, say by means of a lighted taper, for cracks and crevices, with consequent inlet of cold air. Many boiler plants have brickwork of an astonishing character, with a huge continual aggregate leakage of cold air and consequent severe strain and wear and tear, not only of the brickwork, but also the boilers and other equipment. Here, again, the remedy is obvious, that is immediate and systematic patching of all leaks, using say a mixture of boiled tar and ordinary cement, or any of the special cementing materials available for the purpose. A considerable part of the leakage takes place under the fronts of "Lancashire" boilers and in the neighbourhood of the side dampers, and the air-tight damper is not yet standard practice, although introduced many years ago.

The Boiler Setting

Incidentally, with regard to economisers operating with cylindrical boilers it is often much better to use steel casing in place of brickwork, on the same lines as water-tube boilers, being a much neater and lighter arrangement, which is also completely leak-proof while allowing of full inspection at any time merely by removing a series of steel plate sections.

It is essential also to use modern settings for boilers which in the case of the "Lancashire" or other cylindrical type give the minimum area of contact between the brickwork and the shell, while at the same time being much better as regards leakages and short circuiting of gases. For water-tube boilers the standard practice to-day is both the suspended arch and the suspended wall, and the sprung arch and the ordinary solid wall are now obsolete, although still being used in a large proportion of water-tube boiler plant. The basic principle involved, it will be remembered, is to use interchangeable refractory blocks and shapes, which are suspended from overhead steel girders or attached to steel framework, each block being entirely independent of its neighbours and not subjected therefore to compression or other strains. One of the great advantages is that any individual block can be removed immediately and replaced, so that the whole setting is easily maintained—with the minimum expense and trouble—in a high state of efficiency.

A large proportion of the economies to be obtained in connection with the maintenance of steam boiler plant are concerned with the feed-water, and the annual losses still being caused in the steam generation plant of the world because of feed-water troubles are of an astonishing character, particularly in industrial and locomotive boilers. It has been familiar knowledge for over half-a-century that the only method of reducing or eliminating altogether troubles due to scale and corrosion is to soften the feed-water, either by lime or soda ash or base exchange methods, or in the case of large installations by a combination of both operating in series. Lime and soda ash treatment will reduce the hardness under average good conditions of operations to about 5-6° total (5-6 grains per gallon of scale-forming material according to the soap test), which gives no trouble in cylindrical and locomotive boilers with scale or acidic corrosion.

When using base exchange methods the hardness, according to the soap test, is zero, but the water contains soluble salts due to the reaction between the magnesium and calcium bicarbonates (temporary hardness) and the calcium sulphate (permanent hardness) and the base exchange material (sodium alumina silicate), resulting in the hardness being converted into soluble bicarbonate and sodium sulphate.

Corrosion from Dissolved Oxygen

For water-tube boiler operation, and especially under high pressure conditions, base-exchange softened water is not suitable, especially if the boilers are operated with a large amount of make-up. For this reason there has been during recent years a great increase in the use of pure distilled water, using evaporators for bulk production, and the exact methods to adopt depend upon the local conditions, particularly the quality of the water, the pressure and type of the boilers, and the proportion of make-up when operating in conjunction with steam turbines or other prime movers.

The extended use of the water-tube boiler also has brought in its train a new and serious maintenance problem, that is corrosion due to dissolved oxygen. Consequently, for boilers of this type de-aeration is standard practice, the water entering the boilers being reduced to less than 0.10 c.c. of oxygen per 1,000 c.c. So far as can be ascertained, about 0.2 c.c. of oxygen per 1,000 c.c. of water has no corrosive or other chemical action upon steel or iron, but modern de-aerators are able to give water with only 0.02 c.c. per 1,000, that is far above the safety limit. Roughly ordinary condensed water contains about 4.0-4.5 c.c. of oxygen per 1,000 c.c., but as the temperature rises the maximum oxygen content falls rapidly and is only about 0.70 c.c. at 200° F. One of the chief principles, therefore, of modern de-aerators is to subject heated water to a high degree of vacuum and a number of efficient makes of de-aerator are on the market.

Steam Drying Equipment

Further, in connection with feed-water, a highly important method of reducing the maintenance of steam utilising plant, particularly turbines, is to install—preferably in the boilers—steam purifying and drying equipment. Ordinary saturated steam issuing from the surface of the water in the boiler contains two general types of impurity. The first is water particles, which average say 2-3 per cent. of the steam and may be much more, especially in the case of water-tube boilers operating at a high duty. All saturated steam, however, contains some free water, which is objectionable for various reasons, particularly in reducing the thermal efficiency of the boiler plant and rendering difficult the accurate control of

superheated steam temperature, since, of course, this free moisture has to be evaporated and superheated in the superheater coils.

Second, and more serious, are the solid particles apt to be present in steam, largely scale, iron rust, and products obtained by the decomposition of packing and jointing. Such solid particles play havoc with the blades of steam turbines and cause troubles also with reciprocating engines in the way of cutting and grooving cylinders and pistons, and interfering with the efficient action of valves. The disadvantages also of dirty steam for general boiling and process work in the chemical and allied industries do not require emphasis. Highly efficient types of steam separator and dryer are on the market, however, mostly acting on the centrifugal principle. These appliances remove entirely all solid particles and reduce the moisture content to say less than 0.25 per cent.

Finally, it should be emphasised that efficient equipment in connection with boiler plant reduces the maintenance costs. For example, draught not under proper control can often result in serious losses because of mechanical stokers, pulverised fuel burners, and firebars being burned out or otherwise damaged, and the same applies to the firebrick settings. Similary, cast-iron economisers may be badly affected if the inlet water is not kept at a temperature over about 100° F, and it is essential to take the necessary precautions to prevent corrosion of steel tube economisers, both externally and internally. Dust removal from the combustion gases also prevents erosion of induced draught fans, another serious problem in these days of very high duty operation of water-tube boiler plant. Operation with adequate scientific instruments of control, particularly water meters, steam meters, combustion recorders, and pyrometers, reduces the maintenance costs in addition to the fuel bill.

The Maintenance of Drying Ovens

By G. W. SHEARER, Wh.Sc., B.Sc., M.I.Chem.E.

FIXED shelf or movable tray driers are probably much more numerous than all other types of dryers combined. They are usually steam heated, but gas has been used for materials which require higher temperatures, and electricity is frequently used for laboratory and small scale ovens, on account of its convenience. The modern oven of this type is constructed of asbestos filled sheet steel panels, carried on a steel framing, and is arranged for partial recirculation of the air by a fan or fans. The air is made to travel horizontally across the material in the trays, and the vertical spacing of the trays is made sufficiently open to allow free drying. The effect of putting in too many trays to get more material into the oven, defeats its object by increasing the drying time. It is better to have portable tray rack trucks than to use fixed shelves for the trays, as a dry truck can be wheeled out of the oven and replaced by another truck with wet trays in a very short time, and with little loss of temperature in the oven.

The steam consumption of these ovens is quite reasonable, and is frequently not more than 2 lb. of steam per lb. of water evaporated from wet pastes. This steam consumption, of course, varies greatly with different materials, as wet pastes or powders vary so much in the rate at which moisture can percolate from the interior to the surface. The rate of drying also depends upon the velocity with which the air can be made to travel across the surfaces, and this directly affects the total steam consumption. The maximum air velocity which will not raise dust (from the material) should be used.

Uniformity in Drying Time

A point of great importance is to obtain uniformity of drying time all over the oven, as the total time is usually determined by the tray which is last to dry. The time can frequently be reduced by interchanging tray positions when drying is well advanced, but the writer's experiesce is that this is considered too much trouble, consequently makers of ovens have endeavoured to obtain the most uniform distribution of temperature and air velocity. The drying time is affected also by the amount of attention given to the control of the inlet and outlet opening for the discharged air. By keeping these closed until the oven reaches the desired temperature after inserting new trucks, and then opening them wide, moisture will be discharged rapidly for a time; the openings should then be reduced from time to time, as relatively much less moisture will be discharged and the loss of heat in the discharged unsaturated air will be reduced and the temperature easily kept to the maximum. The maintenance of these ovens is very low in cost and when reduced to cost per lb. of dried material is usually insignificant.

Trays vary with the material being dried. For acid pastes, enamelled steel trays are used in very large numbers, but aluminium, stainless steel, bakelite, wood, and other materials are used. Owing to the general desire for rounded corners in the trays, it will be found that trays of standard sizes are much cheaper than those of special sizes, and this fact should be considered when considering the purchase of a new oven. Even with slightly acid pastes, enamelled trays should average over 12 months is use, and this is determined usually by the amount of care used by process workers in emptying the trays after drying. The electrical motors and fans and the steam coils require practically no maintenance, but the steam traps should receive more attention than they generally do. The inside of the ovens will require occasional repainting, but this is infrequent even when drying acid pastes.

Castors on Trucks

The trucks run on castors and are provided with some arrangement to facilitate swivelling and the maker usually hopes for the best, but the purchaser rarely troubles to provide a smooth floor. The result is that process workers in manœuvring trucks weighing over half a ton into and out of ovens, subject the small castors to very severe treatment so that these require attention, and the necessary lubrication is frequently neglected. This type of oven is made in a great number of arrangements, standards being for 1, 2, 3 or 4 trucks, but greater numbers are frequently called for, and the trucks may be in series or parallel with regard to the air circular, or combinations of series and parallel. Doors are provided at one or two sides, or in the ends, if a tunnel stove is desired.

Laboratory ovens, steam heated or electrically heated, are used in great numbers, and are fitted with shelves, hanging pegs or rods for hanks of wool, artificial silk, etc. These are very useful, as a single hank of wool, for instance, will dry in a few minutes, when the oven is already hot. The time required for this drying is very much less than that required for drying the whole oven filled with cold, wet hanks, and this feature is frequently of great value. The steam coils of these ovens will usually stand steam pressures of up to 100 lb. per sq. in., but exhaust steam when available at pressures of even 3 lb. per sq. in. can be and has been used and gives good results in most cases.

For materials that can be handled to advantage in rotary dryers of simple construction, the maintenance costs of such installations are extremely low when operating on materials which are not of a corrosive nature. The only wear which takes place on low temperature dryers is mainly on the tyres and rollers.

The British Industries Fair

A Survey of the Chemical Section

THE British Industries Fair, comprising some 25 miles of stands, opens on Monday next at Olympia and White City, London, and at Castle Bromwich, Birmingham, and continues until February 26. All records for the number of exhibitors, floor space taken and the number of buyers attending have been broken. Altogether there will be 2,442 exhibitors representing 75 British industries.

The Chemical Section, which again is under the auspices of the Association of British Chemical Manufacturers, is in the same position as last year, towards the front of the Main Hall at Olympia. It had been hoped that in conjunction with the Scientific Instruments section these two sections would have had pride of place immediately inside the Addison Road entrance to the Fair, but the unfortunate inability to move certain sections to the new Earl's Court building has necessitated a reversion to last year's layout. The Association has an office at Stand A.176, where literature will be distributed and inquiries answered as to sources of supply. The literature includes the new edition of the Association's main directory, covering all the products of its members, in six languages, namely, English, French, German, Italian, Spanish and Portuguese, and the Directory of British Fine Chemicals, which indicates the manufacturers of over 3,000 fine chemicals in general use. A new feature of the main directory is the inclusion of a section on proprietary and trade marks.

New Features

Attention may be drawn to a number of products which are either new, or are being offered in new form. One of the most important developments is the manufacture in this country of potassium permanganate, for which British manufacturers had previously to go abroad. After initial setbacks oxalic acid is now being made here on a commercial scale. Another interesting extension from existing manufactures is the production of strontium salts, in the form of oxalate, carbonate, chloride and nitrate. Camphor, which has previously been available in small quantities, is now available in large quantities in B.P. and commercial qualities. In another field, cyclohexylamine and phthalic esters may be mentioned. An interesting item in the dyestuffs field is the introduction of a new range of dyestuffs for leather, and the development of a new range of dyestuffs for the direct dyeing of acetate rayon.

During 1936 the British chemical industry has continued to enjoy the improvement noticed at this time last year, in common with trades utilising its products, such as the rubber, paint, iron, steel, plastics and artificial silk industries. The improvement has mostly been due to home consumption. The Board of Trade figures for chemicals, drugs, dyes and colours show exports in 1936 of £21,099,090 as compared with £21,328,503 in 1935 and £20,608,695 in 1934, a decrease of £29,413 on 1935 as compared with an increase of £719,808 in 1935 over 1934. It is interesting to note the tendency of the newer lighter industries to displace the older heavier industries, even in chemical products, *e.g.*, for every £1 of acids exported, we now export some £14 of rayon.

Increased Home Consumption

The increase in home consumption is reflected in the import figures under the same heading amounting to £12,584,235 in 1936, as compared with £11,601,484 in 1935 and £11,136,756 in 1934, taking the latest amended figures. The main increases in imports were in respect of citric acid, calcium carbide, potassium chloride and sulphate, sodium acetate and cyanide, drugs and medicines, and dyestuffs. Even allowing for our increased industrial activity, the increase of nearly a million pounds sterling in a year is rather disturbing, coming as it does on top of an increase of half-a-million in 1935. Some £534,000 of the increase was from Germany.

Many of these imports are products which are non-competitive, such as crude borax and boric acid, calcium carbide, potash salts and speciality dyestuffs, together with certain chemicals which are virtually raw materials for British makers, but there is still too large a proportion of competitive products in spite of additional duties now levied on many of them. With the renewal of the Key Industry Duties for a further ten years we may hope to see an attempt made to reduce this position as far as fine chemicals are concerned.

Amongst the new developments during the year to which attention may be drawn are the preparation of crystalline soda by a new process, the commencement of commercial production of oxalic acid, and the manufacture of metallic magnesium. The development of oil from coal processes has continued, and an entirely new angle is provided by the production of methanol instead of petrol.

What to See at Olympia

Albright & Wilson, Ltd.

Stand A. 168

This year strontium salts are announced by Albright & Wilson, Ltd. It is recognised that there is only a limited market, but the commercial production of these salts in this country on a moderate scale is justified in the opinion of the company. The salts concerned are oxalate, carbonate, nitrate and chloride. Pyrotechnics are responsible for the principal consumption of the carbonate and nitrate salts.

The various forms of phosphorus which have been the principal products of the company since the foundation of the company by Mr. Arthur Albright in 1844, are being shown, together with important compounds of phosphorus, such as oxychloride, trichloride, pentachloride and pentasulphide. The pure and technical grades of phosphoric acid and the numerous phosphate salts occupy an important position in the chemical industry to-day, particularly the pure food phosphates—acid sodium pyrophosphate, sold under the trade name "Antelope," and acid calcium phosphate 80 per cent., universally known as "Ibex."

Baker Platinum, Ltd.

Stand D. 540

This firm is showing a wide range of precious metal manufactures. Platinum laboratory ware includes the popular TF crucibles and dishes, wires, tubing, foil, electrodes and spinnerettes for the manufacturers of rayon. There are also platinum and platinum rhodium gauze catalysts, precious metal salts, liquid gold and platinum for ceramic decorations, and "Rhodanise" rhodium solutions for untarnishable silver.

A. Boake, Roberts & Co., Ltd.

Stand A. 169

Among a varied range of fine chemicals, essential oils and intermediates there are several products of great importance of which A. Boake, Roberts and Co., Ltd., are the only manufacturers in this country, i.e., musk ambrette, musk ketone, musk xylol, phenyl ethyl alcohol, amyl cinnamic aldehyde, benzophenone, geranids, citronellol, citronellal, ethyl aceto acetate, ethyl sodium oxal acetate, heliotropin,

acetins, ethyl phthalate, ionones, iso eugenol, linalyl acetate, and synthetic menthol.

At this stand there is also a display of perfume bases for use in scents, soap, bath salts, creams, brilliantines, dentifrices, lotions, cosmetics, disinfectant sprays, etc., and materials for covering the odours of oils, fats, waxes and solvents, and magnesium, calcium and zinc stearate for cosmetic purposes.

The quality of the terpeneless oils in the past has been such that there has been little use for them in the highest quality products, in spite of the many advantages they should confer. They are now offered as prepared by a new process and their success has been immediate amongst those users who can afford to pay the price for such high quality materials.

Boots Pure Drug Co., Ltd.

Stand A. 218/229

Boots Pure Drug Co., Ltd., are displaying a wide range of products including many medicinal, veterinary and agricultural preparations which are well known both in this country and abroad. A large section of their exhibit is devoted to a biological display showing in particular a complete X-ray plant as used in their Nottingham Laboratories for assaying vitamin D preparations such as Decrose (glucose with calcium glycerophosphate and vitamin D). Many photographs and transparencies illustrate the manufacturing operations used in their works and also show the strict analytical, bacteriological and pharmacological control which is exercised in the testing of their products before they are passed for issue.

A range of bismuth salts, magnesium carbonate, glycerophosphates, iodine, and potassium iodide are displayed. Boots have recently commenced the manufacture of potassium permanganate on a arge scale and samples of this product are also exhibited.

The British Drug Houses, Ltd.

Stand A. 221/225

As on former occasions, the wide range of the B.D.H. activities is illustrated by examples of pure chemicals and preparations for medicinal and pharmaceutical use, in addition to laboratory chemicals and apparatus for general scientific purposes.

The company's activities in the field of chemical research and analysis is demonstrated by the inclusion in the exhibit of pure organic and inorganic chemicals selected from the 5,000 included in the B.D.H. Catalogue of Laboratory Chemicals. Amongst these are examples from a range of 220 chemicals characterised by the word "AnalaR" and guaranteed to conform to the specifications for purity published in the book of "AnalaR Standards for Laboratory Chemicals" as formulated and issued jointly by The British Drug Houses, Ltd., and Hopkin and Williams, Ltd.

Standard methylene blue milk testing tables are shown and the exhibit also contains examples of indicators, microscopic stains, micro-analytical reagents and outfits designed to facilitate various tests in technical and biochemical work.

W. J. Bush & Co., Ltd.

Stand A. 171

This well-known firm is showing all the essential oils that can be distilled in this country, including peppermint and lavender, together with those produced in the Colonies. A complete range of the fine chemicals used in the soap industry, in perfumery and in pharmacy, etc., are also shown. This range includes cinnamic aldehyde (of which W. J. Bush and Co. are the only British manufacturers), chlorine free benzaldehyde, benzoic acid B.P., sodium benzoate B.P., amyl cinnamic aldehyde, terpineol, phenyl ethyl alcohol, salicylic acid B.P., sodium salicylate B.P., and such specialities as vanillin-Bush, coumarin-Bush, and heliotropine-Bush.

The Distillers Co., Ltd. and Associates

Stand A. 189/198

This year The Distillers Co., Ltd. have joined with their associate companies, British Industries Solvents, Ltd. and The Methylating Co., Ltd., in a joint exhibit. The products of all these companies are derived from, or associated with ethyl alcohol. The Distillers Co. have four great industrial distilleries situated strategically throughout the British Isles at London, Liverpool, Hull and Glasgow. The Methylating Co. are able to give unrivalled service to users of alcohol in its usual form of one of the grades of methylated spirit. British Industrial Solvents, Ltd., with their works at Hull and Carshalton, manufacture acetic acid, acetone, butyl alcohol and a wide range of esters.

Alexander Finlay, Ltd.

Stand H. 1050

This old-established firm of soap manufacturers are exhibiting a variety of soaps which are of interest, i.e., a finely powdered soap for the manufacture of scouring powders, an all vegetable oil soap for the use of Jews, and shampoo soap base containing oil rich in the now recognised vitamin F.

The Gas Light & Coke Co.

Stand A. 193

Exhibits at this stand represent the principal substances derived from coal carbonisation in addition to town's gas and coke. Each specimen is taken from large scale production and may be definitely regarded as a sample of what the company is prepared to supply to customers. Here, for example, is a specimen of M.5 xylenol; makers of plastics will appreciate its special significance. Alongside stand phenol and the cresols, all of highest commercial quality, and various forms of refined naphthalene, sublimed (flake), crystal and moulded.

The General Chemical & Pharmaceutical Co., Ltd.

Stand A. 191

The policy of this company has always been continually to increase the purity of analytical reagents (A.R.), and as a part of this policy, important research work is carried on in connection with better methods of analytical control. While all the company's Judex Analytical Reagents A.R. conform to any existing recognised British specifications for analytical reagents, an increasing number are being produced in a purity which is higher than is demanded by any such individual specifications.

Interest is again shown in the range of organic reagents for the detection and determination of minute quantities of metals. The commercial manufacture of these products was due to the initiative of The General Chemical and Pharmaceutical Co. in 1927. The general adaptation, for laboratory chemicals, of the screw capped bottle which was included in last year's exhibits will also be noted.

As an indication of the extent to which the requirements of individual industries are catered for by the company, mention should be made of the exhibits of the special grade (far exceeding in purity any competing A.R. specification) of alpha-naphylamine and sulphanilic acid, these being specially prepared for the gas industry in connection with the Griess-Ilovsky tests.

Hopkin & Williams, Ltd.

Stand A. 251

The exhibition of "AnalaR" laboratory chemicals is again a feature of the stand occupied by Hopkin and Williams. The production of reagents under this registered name is entirely in the hands of the two concerns, Hopkin and Williams, Ltd., and The British Drug Houses. The standards agreed by the

two companies are published in "AnalaR Standards for Laboratory Chemicals." A revised edition of this volume has recently been published. Hopkin and Williams, "AnalaR" chemicals are packed distinctively in a new type of bottle with moulded screw cap, an ideal closure both for protection of the reagent for convenience in handling.

Another class of this company's products is also accompanied by appropriate literature, "Organic Reagents for Metals" (2nd Edn. 1934), which describes the use of 26 special reagents, some of which are exhibited. Four recent products, not yet described in this publication, are phenylarsonic acid (for determination of tin), 5 :7-dibromo-8-hydroxyquinoline (for copper), quinaldinic acid (for copper, zinc and cadmium), and 4-methyl-1 :2-dimercaptobenzene (for tin).

Howards & Sons, Ltd.

Stand A. 222/224

Howards and Sons, Ltd. have a number of new products, both on the fine chemical and the solvents sides. They have recently put on the market d-sorbitol in two qualities, foodstuff and commercial; in the former case it is used as a sweet carbohydrate of high food value for diabetics; in the latter case it possesses considerable advantages when used for softening paper, leather and printing rollers. d-Cannitol, of food stuff quality, is being manufactured for the first time in this country. This firm have also just put on the market for the first time in this country calcium gluconate; it is being manufactured on the small scale so far, but large scale manufacture will follow shortly.

A new product of great importance to the textile trade is Nilox ester oil S, which is an alternative for olive oil in the wool and rayon trades: after extensive research, followed by works' scale trials, Howards and Sons claim that Nilox ester oil is more efficient than olive oil on practically all technical grounds, besides being considerably cheaper than olive oil to-day. It is of a standard quality, has a low iodine value, is very easily removed in the scour, gives a good Mackay test and has a pleasant smell free from rancidity. A new product for the printing and dyeing sections of the textile trade is cyclohexylamine, a powerful dye solvent having many useful applications.

Imperial Chemical Industries, Ltd.

Stand A. 170/174

On the I.C.I. general stand special photographic showstands illustrate the way in which I.C.I. products enter such industries as leather, rubber, textiles, municipal services, paper, paint, soap, refrigeration and laundry and dry cleaning.

Johnson & Sons, Manufacturing Chemists, Ltd.

Stand A. 178

On this stand there is a range of photographic developers which include amidol, acid pyro, azol, glycin, hydroquinone, metol, chlorquinol, etc. There is a special display of a new developer, meritol, which meets the special demands of the miniature type of film, giving almost a grainless image.

Johnson, Matthey & Co., Ltd.

Stand D. 565

Three tons of silver in the form of bullion bars are exhibited at this stand, where there are also exhibits selected from the wide range of this company's products, i.e., platinum laboratory apparatus, cadmium sulphide, cadmium and selenium pigments, and various products for use in ceramic decoration, including liquid gold and liquid platinum.

A small portion of the display is taken up by an exhibit indicating the method of manipulating radium salt when received from Canada, and its packing into specially prepared iridio-platinum containers for use in cancer treatment. Johnson, Matthey and Co., are not only the suppliers of this prepared form of radium, but also the manufacturers of the iridio-platinum tubes and needles, and the silver applicators, employed for medical treatment.

B. Laporte, Ltd.

Stand A. 197

This progressive company possesses one of the finest and best-equipped chemical works in Great Britain, occupying an area of nearly fifty acres. Hydrogen peroxide is their principal product, all strengths being made, including the concentrated quality (40 per cent. by volume) = 130 volumes. Hydrogen peroxide is now almost universally employed as a bleaching agent. The bleaching effect is permanent and eliminates the possibility of tendering the fibres. The company issue a brochure dealing very fully with the use of hydrogen peroxide as a bleaching agent. Sodium perborate, another manufacture, is used as the active constituent in the manufacture of oxygenated soap powders. It is also used for bleaching purposes where the addition of a dry product is preferred to the liquid hydrogen peroxide.

The Malehurst Barytes Co., Ltd.

Stand A. 197

This firm shows a selection of specimens of crude barytes from their mine in Shropshire. Some of the crystals represent the finest grade of barytes found in the country. The simplest product of the company consists of barytes manufactured into a form of sand. This is used mixed with plaster for coating the walls of X-ray rooms, and replaces lead formerly used, at very much less cost.

Monsanto Chemicals, Ltd.

,Stand A. 173

As is customary with Monsanto exhibition stands, the products exhibited are divided into various clear-cut sections, although these are intimately connected with each other from a raw material point of view. The main sections are (1) phenols and cresols; (2) chemicals used in the rubber industry; (3) fine chemicals, including medicinal products and pure chemicals for general industry; (4) germicides, including disinfectants, non-poisonous antiseptics, high powered germicides for preservation purposes; (5) phthalic anhydride and phthalic esters; and (6) benzoic acid and sodium benzoate.

Phenol is exhibited in its usual ice crystal form, melting at 40/41° C, whilst a pharmaceutical grade of detached crystals is also shown melting at a minimum of 41° C, and this portion of the display includes a sample of liquefied crystals to the B.P. specification. The exhibit of cresols is extremely comprehensive, including pale, dark, and water-white cresols, pure tri-cresol, and various special cresols for which Monsanto is well-known. These latter consist of standardised cresol and xylenol mixtures and are each graded according to the particular industry for which they are intended. Those of particular interest include the cresols for synthetic resins which are standardised to contain 40, 50, 55 and 60 per cent. of meta-with, at the same time, standardised contents of ortho-cresol. In addition the separated cresol isomers are shown in the pure state-meta, para and ortho.

National Titanium Pigments, Ltd.

Stand A. 197

This exhibit shows the mineral ilmenite in the form of black sand, which is the raw material from which white titanium products are manufactured. "Tiona" is the registered trade mark under which titanium oxide 98/100 per cent. is marketed, and samples of this are shown on the stand.

The South Metropolitan Gas Co.

Stand A. 195

Several "Metro" chemical products of importance are being shown. "Metro" dry neutral sulphate of ammonia, containing 25.71 per cent. ammonia which is equal to 25.14 per cent. nitrogen, can be stored for long periods without changing its composition or affecting the sacks in which it is transported. "Metro" disinfectant fluid, apart from being over four times more powerful than pure carbolic acid, is easily mixed with hard, soft or even sea water.

Spencer Chapman & Messel, Ltd.

Stand A. 190

This well-known firm is showing the acids for which it is famous, i.e., oleum, 20 per cent., 40 per cent., 60 per cent., and 80 per cent., battery acid, hydrochloric acid (pure and commercial), nitric acid, sulphuric acid, and sulphur trioxide.

Thorium, Ltd.

Stand A. 252

The zircon sand from Travancore, here exhibited, is a highly concentrated product containing an extremely low proportion of iron. It serves for the production of zirconia and zirconium salts and is employed commercially in the manufacture of vitreous enamels and special refractories. Ilmenite sand (titaniferous iron ore) from Travancore is a high-grade, finely grained product that is readily ground and easily decomposed by acid. It serves for the preparation of titania and titanium salts, as well as for the manufacture of titanium alloys.

British Titan Products Co., Ltd.

Stand A. 257

The main product of this company is "Kronos" titanium oxide (commercially pure), which is used wherever the highest degree of whiteness and opacify is desired, and the minimum interference with the other properties of the materials with which it is employed. Where these considerations do not apply, and where cheaper pigment is permissible, "Kronos" titanium whites of various types may be used. A range of these pigments are shown, as well as various manufactured articles in which they have been embodied, including specimens of paints, printing inks, rubber articles, plastics, paper, leather finishes, cosmetics, etc.

Thomas Tyrer & Co., Ltd.

Stand A. 177

Of the very extensive range of chemical products manufactured by Thomas Tyrer and Co. it is only possible to exhibit a number of typical examples serving to indicate the wide scope of this firm's activities, i.e., certain technical chemicals, which find application in the oil, paint, rubber, photographic, cosmetics, and ceramic industries.

As manufacturers of products in "scale" form, Thomas Tyrer and Co. have an outstanding reputation for the excellent appearance and purity of these particular compounds. Samples of their iron ammonium citrate B.P. 1932 and iron quinine citrate B.P. 1932 are shown on the stand, also hypophosphites, of which the company may claim to be pioneer manufacturers in this country.

Whiffen & Sons, Ltd.

Stand A. 192

The main portion of this exhibit, as usual, is devoted to bromides, iodides, alkaloids and essential oils, but during the past year Whiffen and Sons, Ltd., have added several products to their list of manufactures and among the new ones now shown are high specific gravity flotation chemicals for mineral assays, i.e., bromoform S.G. 2.90, acetylene tetrabromide S.G. 2.98, methylene iodide S.G. 3.33, and methylene bromide S.G. 2.50.

Williams (Hounslow) Ltd.

Stand A. 196

This firm is showing a complete range of dyestuffs for all trades. Amongst the new colours shown are the Dermatol range which are specially produced for dyeing high-class leathers and have many distinct advantages over the ordinary leather colours. Colours for foodstuffs, cosmetics, polishes, varnishes, woodstains, cellulose lacquers and synthetic resins are to be found amongst the exhibits.

Progress in Detergents

Some Recent Modifications

PROFESSOR T. P. HILDITCH delivered an address on "Detergents" at the Manchester College of Technology on February 4. Dr. O. R. Howell, in introducing the lecturer, remarked on the valuable work he had done on the chemistry of oils and fats.

Professor Hilditch dealt briefly with the soap industry, which he said had undergone many trials—notably when soap was subject to a tax of 3d. per lb. Fortunately this was removed by Gladstone, and since then the industry had progressed until to-day we were producing 460,000 tons annually, and the quality of the soap had reached a very high standard.

Despite the high quality of the soap, little was known of the actual mechanism of detergency until McBain commenced his classical research at Bristol. As a result of this work, the conception of the ionic micelle was introduced to account for various irregularities in the physical properties of pure soap solutions. An ionic micelle was supposed to consist of a number of fatty acid ions bunched together with their -COO' groups sticking outwards. This structure would then adsorb some of the free sodium ions in solution if a sodium soap were used. Besides these micelles there existed colloidal particles of undissociated soap which were bigger than the micelles, and the adsorption of dirt particles by the neutral colloid was suggested as the explanation of detergest action. The function of the micelle appeared to be that of loosening the dirt from the fabric, since micelles would attach themselves to surfaces in a specific manner. This idea is supported by the work of Adam, Langmuir, Hardy and others, who showed that monomolecular films of fatty acids and related compounds orient themselves on the surface of water, so that the charged (carboxyl) group remains in the surface of the water, while the hydrocarbon chain sticks out perpendicularly. This aids in what is called "wetting out" a fabric—It is a well known fact that soap solution will wet a fabric more rapidly than water alone will do so.

McBain showed too, that soaps hydrolysed very little in solution—contrary to popular belief—and so exploded the theory that free alkali was a necessary factor in detergency. On the basis of these facts, a detergent must have three properties: (1) It must be soluble in water; (2) it must have a "wetting out" action, and (3) adsorptive colloids must be present. Soap fulfils these conditions, but it has other properties which make it unsuitable in certain cases. These are that the calcium salts of most fatty acids are insoluble in

water and so soaps are less effective in hard water, and that soaps are decomposed by dilute acids.

With a view to eliminating some of these disadvantages, several modifications were introduced into the fatty acid molecule. The first and best known case was that of Turkey Red oil, or sulphonated castor oil, where the introduction of a sulphonic acid group conferred solubility on the calcium salt, and so made the detergent effective in hard water. The disadvantage of this material is that the introduction of a new group in the middle of the chain shortens its effective length, and some of the detergent effect is lost. This difficulty was overcome by introducing groups on to the end of the fatty acid chain, and such substances as sodium dodecyl sulphate were not only more efficient than soap, but they were not affected by hard water. The difficulty here was that the alkyl sulphates are prepared from the corresponding fatty alcohols, which can be obtained by a vigorous hydrogenation of the acid.

The introduction of other groups gave rise to the saponines of which cetyl-trimethyl ammonium bromide was an example, while it was somewhat surprising to find that a substance with a very different structure—*iso*propyl naphthalene sulphonic acid—was a detergent too.

Among the more recent modifications were two very interesting products. Triethanolamine may replace the alkali neutralising the fatty acid, and the result is a stable soap containing no water, and having the useful property of being soluble in various organic solvents. These triethanolamine soaps are already widely used in cosmetics. Another new, and very valuable compound was the mono fatty acid ester of a polymerised glycerol. These compounds all have valuable advantages over the soaps, but Professor Hilditch suggested that for economic reasons they were not likely to replace soaps, and they would probably only be used as assistants where their special properties made them necessary.

In the discussion which followed, Dr. Howell would not agree that dirt particles were adsorbed by neutral colloids. He maintained that, contrary to the theories of the London School, neutral colloids did not exist at these concentrations, and that the actual adsorption was done by the miscelles. Dr. Howell based his conclusions on the results of a number of experiments which had been carried out in Manchester on the physical properties of sodium dodecyl sulphate.

After further discussion the meeting closed with a vote of thanks to Professor Hildith for an interesting and stimulating lecture.

New Empire Resources

Shea Nuts, Vanadium and Magnesium

THE "Bulletin of the Imperial Institute" for October-December, 1936, includes a report on a chemical investigation of shea nuts from the Gold Coast, and articles on some vanadium-bearing magnetite deposits of India, the world producction of magnesium, and the various uses of industrial diamonds: shorter notes deal with the evaluation of Derris root as an insecticide and the species to be recommended for planting, the composition and preparation of Avocado oil now coming into prominence as an ingredient of cosmetics, the storage of native foodstuffs in the tropics, the use of boron compounds against insect pests, the fuel resources of the Union of South Arica, possible new uses for Canadian natural gas, etc. Regular features, such as reports on recent research on Empire products conducted by Government departments overseas, a bibliography of current literature on plant and animal products and on mineral resources, and notices of recent books, are included.

A Useful Service of Oil

The report on shea nuts, which deals with a series of samples from the Gold Coast, is in continuation of an investigation which has been in progress by the Imperial Institute for some years in conjunction with the Department of Agriculture in that Colony and also with the Department of Forestry in Nigeria. The object of the work is to determine whether any definite varieties of shea trees exist in those countries, and whether there are any differences in the yield and quality of the fat obtained from nuts derived from individual trees. The factors determined comprised the percentage of kernels in the nuts, the oil content of the kernels and the perccentage of unsaponifiable matter in the oil. The results show that the oil content of nuts from a particular shea tree is liable to vary from year to year, as is also the amount of unsaponifiable matter in the oil. They also tend to support the provisional conclusion, drawn from the results of examination of previous series of samples, that the lower the oil content of the kernels the higher is the percentage of unsaponifiable matter in the oil.

The article on certain vanadium-bearing magnetite deposits of Dhalbum and Mayurbhanj, Bihar, India, has been contributed by G. H. Tipper, M.A., minerals adviser to the High Commissioner for India in London. The distribution of the ore is described, its geology and petrology, composition, mineralogy and origin. Analysis of a number of samples indicates that the material varies considerably from place to place, the vanadium content expressed as the oxide ranging from about one-half per cent. to over seven per cent., whilst the amount of titanium oxide varies from about 10 to 28 per cent. Ores of a similar character are understood to be used in Russia for the preparation of ferro-vanadium, but, although the Indian deposits are certainly richer in vanadium than those known elsewhere, much careful work still remains to be done before their future can be determined.

Extended Uses for Magnesium

Until its extensive adoption in the manufacture of light alloys, the uses and consumption of metallic magnesium were very limited, but now, after a slow beginning, light magnesium alloys are finding widespread applications in machinery generally, and in road and air transport in particular.

An informative article in this issue reviews recent efforts which have been made and the success achieved in the production of this metal, not only in Great Britain, where one firm, at least, anticipates an output of 150 tons per month in the near future, but also in Germany and other continental countries, in the United States and in Japan. For many years the raw material used in the producction of the metal was magnesium chloride, which is obtained in large quantities as a by-product in the German potash industry. Recently, however, the mineral magnesite (carbonate of magnesium) has been found to be more suitable, and a large proportion of the world's output of the metal is obtained from this new source.

CRUDE borax has been mined in Argentina for about 35 years. The borate of lime deposits located in the provinces of Jujuy and Salta, and the territory of Los Andes are estimated to contain between five and ten million tons. The ore in Salta and Los Andes is understood to be about 33 per cent. content and difficult to extract, while the Jujuy ore has an average content of about 36 per cent., in addition being easier to exploit.

Less Known Constituents of Milk

Joint Symposium in London

A JOINT meeting of the Society of Public Analysts with the Food Group of the Society of Chemical Industry was held on February 3, at the Chemical Society's Rooms, Burlington House, . It was held in two sessions, at the first of which the chair was taken by Dr. G. Roche Lynch, president of the Society of Public Analysts, and at the second by Dr. L. H. Lampitt, in the absence of the chairman of the Food Group. Certificates were read in favour of: W. M. Cameron, J. L. Campbell, F. J. Griffin, H. C. Griffith, R. E. R. Grimmett, E. Kennedy, R. H. McKinlay, J. A. Macnair, G. W. Martin, Miss E. M. Pope, A. Rayner, W. J. South, E. Taylor-Austin, J. E. Woodhead and J. H. Young. The following were elected members of the Society: G. H. Clarke, L. C. Dutton, J. C. Giblin, R. W. Gillham, R. M. Hamilton, W. T. Lunt, W. D. McFarlane, W. S. Patterson, T. C. Williams and G. H. Wray.

Routine business was followed by a symposium on "The Less Known Constituents of Milk and Their Examination," in the course of which papers were presented by Professor T. P. Hilditch, Mr. R. T. S. Twigg, Professor H. D. Kay, Dr. E. C. V. Mattick, Dr. S. J. Folley, Dr. J. H. Bushill, Dr. L. H. Lampitt, Mr. D. F. Filmer, Mr. E. B. Anderson and Dr. R. MacWalter.

Minor Component Acids

Professor T. P. HILDITCH, dealing with "Some Minor Component Acids of Milk Fat and their Possible Significance," said that out of 100 molecules of fatty acid combined as mixed triglycerides in normal cow milk-fat, there were about 27-35 mols. of oleic and 24-27 mols. of palmitic acid, whilst butyric, myristic and stearic acids came together next with 7-10 mols. each; the rest of the acids might be looked upon as minor, though usually definitely characteristic, component acids. Of the minor saturated component acids, the presence of lauric was to some extent doubtful. Caproic was usually more prominent than caprylic or capric acids in cow milk-fat.

There was present in normal butter-fats a very small quantity (usually well below 1 per cent.) of polyethenoid acids containing 20 (and possibly 22) carbon atoms. Consideration of the proportions of fully saturated glycerides in cow milk-fats, which were abnormally high (for a given content of saturated acids in the total fatty acids) when compared with all other natural fats, led the author and his co-workers to suggest that in milk-fats the lower fatty glycerides were produced from pre-formed oleo-glycerides by a combined process of oxidation and reduction.

When cod-liver oil was included in the diet of cows, some of its characteristic polyethenoid C_{20} and C_{22} acids passed into the milk-fat, which then contained 5-7 per cent. of these acids. At the same time the yield of milk-fats fell and its composition was considerably altered; the amount of the characteristic lower fatty glycerides produced was reduced to about one-third of the normal, and that of myristic, palmitic and stearic glycerides was also reduced, but the production of oleo-glycerides was only slightly affected. The effect was temporary, and, after the animal ceased to receive cod-liver oil, production of milk-fat of normal composition and quality was resumed within a few days.

Oxidation-Reduction Systems

Mr. R. S. TWIGG, in a paper on "Oxidation-Reduction Systems in Milk," said investigations had been carried out to ascertain the capacity of raw and heated milks (whole and skimmed) to reduce a standard concentration of methylene blue, apart from the reducing activities of any bacteria. The work was of importance in view of the recent introduction of the methylene blue test for the bacteriological grading of milk under the Milk (Special Designations) Order, 1936. A special milk was used, of very low bacterial count, and no multiplication of the bacteria occurred during the progress of the investigations, which were carried out in the absence of oxygen.

From the results obtained it was considered justifiable to consider that raw milk possesses a natural reducing system of its own. Separation of the cream removed sufficient reducing substrates and any necessary enzymes to prevent skim milk from reducing the methylene blue. Heating to 63° C. for half-an-hour, *i.e.*, pasteurisation, wholly or partially inhibited enzymes necessary for the full activity of the reducing system of whole milk. Pasteurised skim milk behaved like pasteurised whole milk, but with even less reducing activity. Cream, itself, if left unheated and suspended in water, reduced methylene blue. Pasteurisation, or heating to a higher temperature, destroyed its reducing activity.

Many substrates were tested for their ability to reduce methylene blue in the presence of washed cream or membrane suspensions. Of all these, only aldehydes and hypoxanthine showed definite reducing activity. Attempts were made to dialyse either whole milk or unwashed cream with a view to building up the reducing system. No success had been attained, and it appeared that dialysis rather quickly inactivates certain of the enzymes. Recent experiments showed that the ascorbic acid content of milk played little or no part in the reduction of methylene blue under anaerobic conditions.

Lipase and Phosphatase

A paper on "Some Recent Work on the Lipase and Phosphatase of Cow's Milk," was presented by Professor H. D. Kay, Dr. E. C. V. Mattick and Dr. S. J. Folley. After outlining the methods of estimating phosphatase, the authors described the difficulties of devising a satisfactory method of estimating lipase in milk. The best results were ultimately obtained by the use of tributyrin in association with a special buffer, at *p*H 8.5, and with bacteriological control before and after the estimation, the hydrolysed butyric acid being distilled off and titrated. The conditions as to shaking, etc., must be rigidly standardised. It was shown that all raw milks contain lipase in amounts varying from cow to cow and during the lactation period. Milk lipase is more readily destroyed by heat than phosphatase. There is more lipase in milk serum than in milk-fat, but the reverse applies to phosphatase. It is probable that the lipase and phosphatase in milk are unrelated, and that the phosphatase content affords an index of the efficiency of the mammary gland.

The Estimation of Catalase

Mr. E. B. ANDERSON and Dr. R. J. MCWALTER, in a paper on "The Estimation of Catalase," said that in continuation of work on the enzymes of milk it became necessary to study the methods proposed for the estimation of catalase. These divide themselves into two main groups, gas volumetric measurement of the oxygen evolved from hydrogen peroxide, and volumetric estimation of the peroxide undecomposed, either directly with potassium permanganate or indirectly by iodine liberation from potassium iodide. These tests are critically surveyed and a modified iodimetric test is described which avoids the difficulties experienced by other workers. It is pointed out that the estimation cannot be other than on an empirical basis, as the substrate gradually destroys the enzyme, and therefore conditions have been chosen which allow the reaction to approach completion in a reasonable time with maximum destruction of subtrate. The results agree quite well with those obtained by a refined gasometric method.

A paper on "Present Knowledge of the Minor Nitrogenous Constituents of Milk," was presented by Dr. J. H. Bushill, Dr. L. H. Lampitt and Mr. D. F. Filmer.

Letters to the Editor

Inventions and Designs at the B.I.F.

SIR,—Under the provisions of the Patents and Designs Act, the exhibition of an invention or a design at an industrial or international exhibition, which has been duly certified as such by the Board of Trade, does not prejudice the validity of a patent or invalidate the registration of the design that may be granted on the invention or design, as the case may be, provided certain preliminary steps are taken at the Patent Office. These steps include the payment of a stamp fee of £1 for an invention and 5s. for a design, and the preparation of a brief description, and in the case of a design also of a representation.

Exhibitors are warned, however, that the taking of such steps is *not* an application for a patent or design registratiton. If either of these forms of protection is desired by the exhibitor, application for the same must be made before or within six months from the date of the opening of the exhibition. It would appear, however, that, in a certain case, the exhibitor cannot prevent another person securing a patent or a design registration if such other person applies for the same before the exhibitor does so.

Therefore, exhibitors might as well apply straight away for a patent or design registration, as the case may be, and thereby make their position less uncertain; incidentally, by so doing they would save £1 for an invention or 5s. for a design.—Yours faithfully,

GEE AND CO., Patent Agents.

British and Foreign Patents

SIR,—It is easy to take something from its context, link it with pronouncements such as those of Professor J. F. Thorpe and Dr. E. F. Armstrong, suggest that "this has the appearance of being a clear instance of the preference of the Englishman for the inventions of every country but his own," and obtain a gratuitous advertisement of a process at the expense of the alleged lack of patriotism of the professional man. This is virtually what Mr. D. H. B. Wride, director of Sulphur Patents, Ltd., c/o I.C.I., Billingham, at tempts in his letter appearing in THE CHEMICAL AGE of February 6.

What are the facts? For fourteen years I have been writing these reviews, and have attempted honestly to give a "thumbnail sketch" of the outstanding developments. Never hitherto has there been any complaint of any kind: on the contrary, quite a few eulogistic letters have been forthcoming, about the fairness and modernity of what has been written. The review to which Mr. Wride specifically refers had relation to "Conditions in the heavy chemical industry *in 1936*." Such reviews must necessarily suffer from the defects incidental to a necessary compression. Much ground has to be covered, in a limited space.

But has Mr. Wride any cogent justification for what he alleges? Was not the Billingham process, about which Mr. Wride is particularly concerned, *au fait accompli in* 1935, *and did I not say, in my review* (THE CHEMICAL AGE) *of* 1935:

> . . . The Billingham process, which has recently been established on a practical scale, provides for the reduction of sulphur dioxide (implying that the I.C.I. had developed a new process for concentrating the SO_2 of the SO_2-containing gases) by coke, at a high temperature?"

Consider now the quintessentials of my review of 1936 as regards sulphur. It dealt with (a) interesting Russian experimental work, (b) the fundamentals of the production of sulphur from SO_2 by thermal reduction, (c) referred briefly to the Sulphidine process, and indeed made the following reference to the work of the I.C.I.:

> ". . . It should not be overlooked that this country was responsible for the pioneering work in developing a practical process for utilising the carbon reduction reaction on metallurgical gases. N. P. Appleby's (I.C.I.) account of the use of sodium sulphite and aluminium chloride as an absorbing medium, for gases containing weak concentrations of SO_2, is still fresh in one's memory."

Reading the 1935 and 1936 reviews in conjunction, could anything savour less of what is imputed? Your readers are in the best position to judge.—Yours faithfully,

P. PARRISH.

Colwyn,
57 Westcombe Park Road, S.E.3.

Applying Organic Matter to the Soil

SIR,—As a consequence of the widespread interest which is now being taken in the subject of humus and the maintenance of soil fertility with regard to organic matter, we have recently been receiving inquiries regarding the possibility of using cyanamide as a means for breaking down organic matter. It has been somewhat difficult for us to deal as we should have wished with these inquiries owing to the fact that our advice might have led to a possible infringement of the patent of Adco, Ltd. The use of cyanamide, either alone or in combination with other substances, is the subject matter of seven claims in their Brit. Pat. 219,384.

We therefore thought it advisable to discuss this matter with Adco, Ltd., with a view to clarifying the situation, and pointed out to them that the use of cyanamide alone for this particular purpose would be in the interests of agriculture generally. As was expected, Adco do not desire that their patent should be in any way obstructive to the progress either of horticulture or of agriculture, especially in view of the much greater attention now being devoted to the subject of humus.

This decision is of considerable importance, for, although the synthetic manure made by Adco special reagents is particularly valuable in horticulture, the use of cyanamide for this purpose presents greater possibilities in agriculture owing to its relative cheapness. We emphasise, however, the fact that when cyanamide is used alone neither phosphates nor potash are added, whereas the Adco reagents do produce a synthetic farmyard manure approximating in composition to that of ordinary dung. Well rotted compost made with cyanamide alone, however, is undoubtedly the cheapest method of supplying organic matter in a form which allows its immediate utilisation by the following crop.

In addition to the decomposition of organic matter by the Adco process, considerable attention is being given to the use of cyanamide when applied to organic matter to be directly incorporated in the soil. The organic matter thus incorporated may be straw or refuse of a similar nature, or it may be a green manuring crop grown specially for the purpose. These methods of direct incorporation are of special value in cases where the "heap" process would be uneconomic owing to distance of haulage or lack of adequate water supplies and, although the subject still requires further investigation, it appears that it will be of considerable importance in increasing the humus content of soils which are in danger of losing their fertility. For the arable farmer who is able to allow time for the decomposition of straw, etc., in his soil, there is very little evidence that preliminary rotting in the heap with all the expense entailed offers any compensating advantage provided that sufficient nitrogen is applied with the straw to ensure its decomposition just as in the compost heap.

As a result of the close co-operation existing between Adco, Ltd., and ourselves, their extensive experience, on the subject of the breakdown of organic matter, gained as a result of research extending over a number of years, is at the disposal of those interested.—Yours faithfully,

For SHAW SCOTT AND CO., LTD.,
P. A. BOTTOMLEY,
Agricultural Department.

14 and 19 Leadenhall Street, E.C.3.

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Waste Lubricating Oils

New Refining Plants Built in Sweden

A NUMBER of oil refineries for utilising and refining waste lubricating oils are now being built in different towns by the Stockholm Oljeraffinaderi. A.B. The biggest of these plants now working is located at Vasteras in Central Sweden and has a daily capacity of 5,000 kilograms of oil. Large values will in this way be preserved, Sweden's import of lubricating oils being 60,000 tons a year. Hitherto, the refining company has mostly contracted with Swedish industries for delivery of their waste oils and the return of refined oils at a certain fixed charge for the refining, but the company is now also buying waste oils for refining and resale.

Personal Notes

MAJOR T. KNOWLES, director of Monsanto Chemicals, Ltd., has been re-elected president of the Institute of Export for 1937.

DR. E. F. ARMSTRONG, F.R.S., has been appointed a director of The Commercial Gas Co., in place of the late Mr. Frederick McLeod.

MR. JAMES HALL, of Ardradam, Argyllshire, oil refiner, late of 28 Kyle Street, Glasgow, who died on November 9, left personal estate in Great Britain valued at £73,110.

MR. GEORGE H. DUNCAN, who has been secretary of the Barter Trading Corporation, Ltd., for the past seventeen years, has been appointed a director of the company. Mr. Duncan will continue to act also as secretary.

MR. JOHN D. POLLOCK, chairman of Metal Industries, Ltd., and of the British Oxygen Co., Ltd., has received the honorary degree of D.Sc. at a convocation at Oxford University. Mr. Pollock has been a notable benefactor to the Engineering and Physics Departments at the University. He is also a Carnegie Trustee.

MR. HARRY HEY, chief metallurgist of the Electrolytic Zinc Co., has been elected chairman of the newly formed Melbourne branch of the Australasian Institute of Mining and Metallurgy.

MR. THOMAS JONES, of Oswestry, and Mr. Arthur R. Loten, of Hull, have received the congratulations of the Pharmaceutical Society on their having been associated with the Society since 1868.

MR. L. K. EVERITT has been appointed a director of Edgar Allen and Co. He is a son of the chairman of the company, Mr. C. K. Everitt, and has charge of the steel department of the Sheffield works.

ALDERMAN W. G. WILKINS, of Derby, who died in November last, left estate valued £14,570. He founded the firm of Oliver Wilkins and Co., Ltd., which now forms part of Imperial Chemical Industries, Ltd.

LIEUT-COL. WALTER W. WIGGIN, of Kings Norton, late chairman of Henry Wiggin and Co., Ltd., Birmingham, who died on November 4, at the age of 80, left estate valued at £180,568, with net personalty £151,031.

Chemical Notes from Foreign Sources

Russia

A PROCESS FOR PRODUCING ZIRCONIUM OXIDE from Russian ores has been developed by the Rare Metal Research Institute.

Czechoslovakia

A MODERN GLUE AND GELATINE FACTORY is being built near Carlsbad by a firm at present outside the cartel.

A SHELLAC-BLEACHING FACTORY to cater for home and export demand has been erected by the Oderberger Chemische Werke A.G.

LINOLEUM MANUFACTURER by a new and improved process will shortly be commenced by the firm of Urbach and Co., of Teplitz-Schönau. Up till now, linoleum has not been made in Czechoslovakia.

France

A NEW SYNTHESIS OF ANISIC ALCOHOL (Quelet and Allard) involves condensation of anisole with formaldehyde followed by esterification and saponification with alcoholic potash.

A RECENTLY PATENTED PROCESS for the manufacture of citric acid from molasses is based on the discovery that salts of uranium, manganese and zinc influence the growth processes of citric plants so as to give a high yield of citric acid. It is also claimed that the organism formed by crossing *Mucor priformis* with *Aspergillus niger* gives a better yield of the acid than either organism alone. The former organism is found in pears and apples; the latter, in gall apples.

Hungary

A DIABETIC FLOUR WITH LOW CARBONHYDRATE CONTENT has been prepared by J. Gsell using inulin-containing materials (chicory root, black hellebore and the like). A fibrous intermediate product is formed which is hydrolysed by suitable organisms (*B. amylobacter, Aspergillus oryzae* and others).

A TOBACCO OIL WITH HIGH INDUSTRIAL VALUE is now being extracted by the Hungarian Tobacco Monopoly from the seeds which were formerly discarded. Favourable contracts have been arranged with leading oil mills for treatment of 30 to 40 wagon loads of the seed each year.

VITAMIN C HAS BEEN FOUND TO EXIST not only in vegetable matter but also in certain animal organisms. According to F. Kokas, three varieties of molluscs from Lake Balaton (Unis, Anodonta and Dreissena) contained 0.80 to 1.96 per cent. of the vitamin.

RICH LEAD DEPOSITS are reported to have been discovered at Falubattyan, in the county of Weissenburg.

Norway

NORSKE SALTPRODUKTER A/S, with a capital of 20,000 Kroner (about £1,000) has been formed at Haugesund to manufacture chemical products from common salt.

Japan

A NEW PROCESS FOR MAKING SYNTHETIC METHYL ALCOHOL is based upon passage of carbon monoxide and hydrogen over reduced copper at a temperature of 230° C. and a pressure of 80 to 100 atmospheres. The crude product (95 to 97 per cent.) is purified by simple distillation.

Manchuria

SOYA BEAN OIL IS BEING EXTRACTED by an alcohol process in an experimental plant of the Manchurian Soya Bean Co., a subsidiary of Mantetsu. The beans are boiled in alcohol, the liquid is cooled, and the oil is separated. The alcohol which takes up much of the water from the beans, is then distilled. If the chlorides can be separated from the liquid, it should be possible to regain 99.8 per cent. absolute alcohol.

Germany

THE I. G. FARBENINDUSTRIE reports satisfactory trading in the last quarter of 1936, especially in nitrogen, chemicals and synthetic textiles.

PRODUCTION OF OIL VARNISHES and nitrocellulose lacquers has now been commenced at the new factory of Lacquer Works, Ltd., in Haifa.

Italy

COMPAGNIA ETIOPICA ESPLOSIVI has been founded at Milan with a capital of one million lire (about £10,700) to exploit explosives manufacture in Italian East Africa.

A NEW METHOD OF OBTAINING STABLE SOLUTIONS of colloidal silver, described by M. Morgnani in "La Chimica e L'Industria," January, 1937, is based upon passage of an alternating current between pure silver electrodes immersed in a solution of sodium gallate. Success depends largely upon the maintenance of an optimum hydrogen ion concentration, a pH of 6.8, using a 1 pro mille solution of sodium gallate, being found the most satisfactory. Colloidal silver prepared by the process described has a pink colour and the solutions acquire a metallic blue reflex when concentrated. When observed under the ultra-microscope the particles are seen to be endowed with a strong brownian movement. Stability does not suffer after heating up to a temperature of 90° C.

From Week to Week

THE FASTNESS TO LIGHT of dyed materials was the subject of an address delivered at University College, Nottingham, by Mr. F. L. Goodall, on February 4.

MR. H. A. S. GOTHARD has removed from Kimberley House, 14-17 Holborn Viaduct, to Holborn Viaduct House, 12 Holborn Viaduct, London, E.C.1. His telephone number remains as before, City 1746.

ALTERATIONS TO THE REGENT FACTORY, Linlithgow, of Imperial Chemical Industries, Ltd., are proceeding at a cost of £15,000. The factory, which opened in 1903 and closed down in 1935 through its activities being transferred to Ardeer, Ayrshire, is to re-open shortly.

A CRISIS IN THE POTTERY INDUSTRY is threatened as a result of one of the largest firms in the industry withdrawing from the Earthenware Association on the eve of a demand by the operatives for increased wages. This was revealed by Mr. Arthur Hollins, M.P., general secretary of the National Union of Pottery Workers, at a meeting held at Hanley, Stoke-on-Trent, on February 7.

A COURSE of three special London University Lectures on "The Artificial Transmutation of Matter," will be given at King's College, by Professor James Chadwick, F.R.S. (Lyon Jones Professor of Physics in the University of Liverpool, on March 2, 9 and 16. The first lecture will be a historical and general survey, and the second and third will deal with experimental results and their interpretation.

PRELIMINARY WORK ON EXTENSIONS to the Lochaber (Inverness-shire) factory of the British Aluminium Co., started on February 8. The British Aluminium Co. announced recently that it was to extend productive capacity of these works through subsidiary companies, the Lochaber Power Co. and North British Aluminium Co. Lochaber power scheme is one of the largest in Britain. Work on the extension will employ up to 150 men. The extension will involve laying two new pipe-lines alongside the existing pipes 1,000 ft. down the mountain side to the factory power house.

THE SUGAR COMMISSION has been asked by the Government to report on the possibility of establishing a beet-sugar factory at Pembroke. Lieutenant-Colonel F. C. C. Balfour, chairman of the Commission is to ascertain whether local farmers would be prepared to grow 10,000 to 15,000 acres of sugar-beet. It is stated that to justify the establishment of a factory contracts for at least 10,000 acres would be necessary. Some farmers have already said that the price of 37s. a ton, which has been fixed for 1937 contracts, is not economically attractive. The erection of a beet-sugar factory at Pembroke would mean a capital outlay of over a quarter of a million pounds and the consumption of large quantities of coal.

THE FOLLOWING increases in nominal capital are announced: Cow and Gate, Ltd., Cow and Gate House, Guildford, addition of £700,000 beyond the registered capital of £700,000. (Additional capital divided into 400,000 preference shares of £1 and 6,000,000 ordinary shares of 1s. each.) H. Ferguson and Co., Ltd., electrical and chemical engineers, Gosbrook Works, Caversham, Reading, addition of £1,500 in £1 shares beyond registered capital of £500. Shaw Chemical Co., Ltd., 6 New Walk, Leicester, addition of £6,500 beyond the registered capital of £3,500 (additional capital divided into 1,801 cumulative 7½ per cent. preference and 4,699 ordinary shares of £1 each.)

OUR READERS who told their bankers to deduct the odd shillings and pence in their accounts on January 20, and credit them to the King George V National Memorial Fund, will rejoice at the success of a novel and ingenious scheme. The product of the bankers' coupons ran, as had been hoped, approximately into six figures, and the stimulus of the scheme added another £100,000 to the Fund in the normal way. As a further £100,000 is the estimated value of gifts of land, it is now certain that over half-a-million sterling will be available for the primary object for which the shillings and pence scheme was launched, the provision of playing fields for the young up and down the country. This is a splendid result and opens Coronation year in a highly auspicious manner.

THE RM.55,000,000 LOAN FOR GELSENBERG BENZIN A.-G., which was sponsored by the Deutschebank Discontogesellschaft, was oversubscribed on February 4, the first application day. The loan is guaranteed by a mortgage over the Gelsenberg's future plant, while the debt service security is reinforced by a guarantee of Vereingte Stahlwerke. When production starts, Gelsenbergs will, with Leunawerke, another subsidiary of Vereingte Stahlwerke, be the largest hydrogenation works in Germany. But whereas Leunawerke uses lignite as raw material and proceeds by the costly Bergius process, depending on high temperature pressures, involving rapid wear and tear of plant, Gelsenbergs will start from coal by using the Fischer Tropsch process of low temperature distillation, which deteriorates the plant far less and ends in a higher petroleum yield, with very little waste.

PIPES MADE OF MIPOLAN, a new German material for non-metallic pipes, rustless, water resisting and tasteless, will be shown at the 1937 Leipzig Spring Fair.

THE AMERICAN SECTION of the Society of Chemical Industry will hold a meeting next Friday, at the Chemists' Club, New York, at which Dr. Wallace P. Cohoe is to be the guest speaker. His paper is entitled "Permanent Sizing with Alkali Soluble Cellulose Ethers."

UNILEVER, LTD., AND ITS ASSOCIATED COMPANIES, which have always granted members of the male staffs in the defence forces facilities to attend camp, have decided to grant leave (with a maximum of fourteen days) on full pay to all attending annual training. This leave will be in addition to the ordinary annual holiday on full pay.

MORE THAN 6,500 WORKPEOPLE employed by Pilkington Bros., at their glassworks at St. Helens and Doncaster will benefit by the decision of the St. Helens Plate and Sheet Glass Industrial Council that the wages of all workers represented on the council shall be increased. The increases, which operate from February 8, are as follows:—Males over 21 years, 2s. weekly; males under 21, 1s. weekly; females 18 years of age and over, 1s. 6d. weekly; females under 18 years, 9d.

AFTER TEN YEARS OF RESEARCH, Mr. John Eklund has just successfully completed large-scale experiments for recovering platinum from the most difficult Northern Transvaal ores, which have hitherto defied every ordinary method of extraction on a commercial scale. Mr. Eklund claims extractions upwards of 88 per cent. at a cost of 5s. per ton by means of his new chemical treatment. Steps are now being taken to test the process on a full commercial scale. If the expected success is achieved, South Africa will become the world's greatest platinum producer, for even if the price fell to £4 sterling an ounce, Mr. Eklund claims that his process could still be profitably employed.

THE DECHEMA Deutsche Gesellschaft für chemisches Apparatewesen E.V. (German Society for Chemical Engineering), which is organising the Achema VIII chemical engineering exhibition (July 2 to 11) on the occasion of the national congress of German chemists in Frankfort-on-Main, reports that at the close of the first term set for advance bookings (January 15) there had been rented a net floor space for exhibition purposes totalling about 105,000 sq. ft. by 275 important firms of the German chemical plant, equipment, and accessories industry. On the same date in 1934, prior to the Achema VII at Cologne, 200 firms only had rented 52,000 sq. ft. floor space.

New Companies Registered

Featly Products, Ltd., 36 Duke Street, St. James' S.W.1.—Registered January 21. Nominal capital £250. Manufacturing chemists and druggists, etc. Subscribers: Anthony J. Borin and B. Davis.

H. Russell (Soaps and Disinfectants), Ltd., 59a Spencer Street, Liverpool, 6.—Registered January 23. Nominal capital £300. Makers of soaps, disinfectants, etc. Directors: Lilian M. Russell and L. H. Russell.

Lancashire Chemical Works, Ltd., 46-7 London Wall, E.C.2.—Registered February 4. Nominal capital, £6,000. Manufacturers of and dealers in chemicals and chemical products, etc. Directors: Dr. Walter Hene, and Dr. R. Hecksher.

Fluxalloys, Ltd., Spencer House, South Place, E.C.2.—Registered February 8. Nominal capital, £500. Suppliers and distributors of fluxes, solders, brazing and welding materials, chemicals, metals, tools, alloys in the form of rods, wires, tubes and sheets, dealers in proprietary artieles of all kinds, etc. Directors: Charles C. Hyde, E. W. S. Press, D. C. Bryer and P. Swan.

W. G. Wilson, Ltd.—Registered February 8. Nominal capital, £5,000. Manufacturers of, dealers in and agents for chemicals, etc. Directors: Walter G. Wilson, 11 Queen Victoria Street, E.C., C. G. Robinson, and F. A. W. Dampney.

Discoflex Filter Co., Ltd., Bisley Works, Whittall Street, Birmingham.—Registered February 9. Nominal capital £2,000. To acquire the business of filter manufacturers carried on by Paul Belyavin and Belfrost Diesels, Ltd., and to carry on the business of manufacturers of and dealers in apparatus of all kinds for the purpose of filtration, cleansing, draining or refining fluids, filter presses and pumps, etc. The directors are: Paul Belyavin, A. C. Hale, W. Frost, and S. C. Hale.

B. and P. Products, Ltd.—Registered February 3. Nominal capital, £250. Manufacturers, factors, agents and merchants of chemical products, plant and apparatus of all kinds, etc. Subscribers: Mrs. Margaret Boulton, Bird Place Cottage, Henley-on-Thames, and Mrs. G. M. Roxburgh.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

Preparation of enzyme material.—Standard Brands, Inc. July 27, 1935. 18189/36.

Method of preparing luminescent material.—Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 30, 1935. 19213/36.

Process for de-acidifying liquids, particulary water.—Permutit, A.-G. July 27, 1935. 19226/36.

Process for the manufacture of basic steel.—Soc. Anon. des Forges et Acieries du Nord et de L'est. July 27, 1935. 20289/36.

Production of suspensions of pigments.—British Titan Products Co., Ltd. July 26, 1935. 20326/36.

Manufacture of artificial materials.—I. G. Farbenindustrie. July 26, 1935. 20732/36.

Manufacture of azo dyestuffs.—I. G. Farbenindustrie. July 27, 1935. 20733/36.

Manufacture of laminated glass.—I. G. Farbenindustrie. July 26, 1935. 20735/36.

Process for dyeing or colouring cellulose esters and cellulose ethers.—J. R. Geigy, A.-G. August 1, 1935. 20736/36.

Manufacture of acetals.—A. Contardi, and B. Coccia. July 26, 1935. 20762/36.

Production of fluorine-containing layers on light metals.—I. G. Farbenindustrie. July 27, 1935. 20771/36.

Manufacture of vat dyestuffs.—I. G. Farbenindustrie. July 27, 1935. 20772/36.

Method of producing aluminium oxide.—A. S. Burman. July 29, 1935. 20881/36.

Process for the production of homogeneous reaction masses.—Beck, Koller, and Co. (England), Ltd. August 1, 1935. 21263/36.

Manufacture of ply-wood barrels.—I. G. Farbenindustrie. July 31, 1935. 21305/36.

Manufacture of stable therapeutic products from intestinal mucous membrane.—I. G. Farbenindustrie. August 1, 1935. 21455/36.

Catalysts.—J. L. De Roos. August 1, 1935. 21469/36.

Production of cellulose ethers.—E. I. du Point de Nemours and Co. August 1, 1935. 21508/36.

Synthesis of thiazole compounds, salts, or derivatives, and the like.—Research Corporation. March 18, 1935. 2248/37.

Specifications Accepted with Date of Application

Manufacture of condensation products and substantially olefine-free oils from olefine-containing oils.—W. J. Tennant (Henkel and Cie, Ges.). May 20, 1935. 460,435.

Manufacture of monobromopyrene.—W. W. Groves (I. G. Farbenindustrie.) July 24, 1935. 460,439.

Manufacture of amino compounds of the anthraquinone series.—British Celanese, Ltd., G. Lord, and G. Reeves. July 25, 1935. 460,440.

Colouration of textile and other materials.—British Celanese, Ltd., and P. F. C. Sowter. July 25, 1935. 460,575.

Seed grain disinfection.—A. Carpmael (I. G. Farbenindustrie-) July 25, 1935. 460,521.

Manufacture of amino-carboxylic acid nitriles and amino-carboxylic acids.—I. G. Farbenindustrie. July 26, 1934. 460,372.

Manufacture of water-soluble chlorites.—L. Mellersh-Jackson (Mathieson Alkali Works). July 26, 1935. 460,374-5.

Production of chlorine dioxide.—L. Mellersh-Jackson (Mathieson Alkali Works). July 26, 1935. 460,376.

Applications for Patents

Manufacture of drying-oils.—A. Carpmael (I. G. Farbenindustrie.) 2185.

Manufacture of lacquer raw materials.—A. Carpmael (I. G. Farbenindustrie.) 2328.

Preparation of synthetic derivatives of lysergic acid.—Chemical Works, formerly Sandoz. (Switzerland, June 20, '36.) 2091.

Manufacture of condensation products of anthraquinone series.—Chemical Works, formerly Sandoz. (Switzerland, January 27, '36.) 2418.

Manufacture of vinyl ethers.—Coutts and Co., and F. Johnson (I. G. Farbenindustrie.) September 11, '36. 1831.

Synthetic-resin materials, etc.—De Havilland Aircraft Co., Ltd., Aero Research, Ltd., and N. A. Bruyne. 1853.

Manufacture of cellulose articles.—Deutsche Hydrierwerke, A.-G. (Germany, Jan. 21, '36.) 1845.

Manufacture of cellulose derivatives.—H. Dreyfus. 2301.

Polymerisation of halogen butadienes.—E. I. du Pont de Nemours and Co. (United States, Jan. 25, '36.) 2135.

Polymerised organic compounds.—E. I. du Pont de Nemours and Co. (United States, Jan. 25, '36.) 2217.

Manufacture of substituted carboxylic acid amides, etc.—E. I. du Pont de Nemours and Co. (United States, Jan 24, '36.) 2218.

Manufacture of condensation products.—W. W. Groves (I. G. Farbenindustrie.) 1806.

Manufacture of monoarylides of aromatic dicarboxylic acid halides.—W. W. Groves (I. G. Farbenindustrie.) 2166.

Treatment of oxidation products of aliphatic hydrocarbons. Henkel and Cie, Ges. (Germany, March 2, '36.) 2340.

Production of oxidation products from aliphatic hydrocarbons.—Henkel and Cie, Ges. (Germany, March 31, '36.) 2341.

Carrying-out chemical reactions.—D. Gardner. 1877.

Chemical and Allied Stocks and Shares

APART from an easier tendency which developed in British Government stocks towards the end of the week, the stock and share markets have shown a buoyant trend and shares of chemical and associated companies participated in the movement to higher prices. Imperial Chemical have improved from 40s. 6d. to 40s. 10½d., and Salt Union have advanced further from 45s. 3d. to 47s. 6d. on market hopes of a larger dividend or the distribution of a scrip bonus. Monsanto Chemicals 5½ per cent. preference were more active around 23s.; buyers being attracted by the yield offered. British Drug Houses were also more active and have changed hands around 22s. 3d., it being pointed out that the company has a steady dividend record and that on the basis of the 5 per cent. paid last April, the yield offered is favourable. British Glues were again active and have remained at 11s. General Refractories at 31s. 3d. have more than held their rise of the past week, aided by the favourable dividend estimates current in the market. International Diatomite remained at 7s.

British Oxygen continued to attract attention on the possibility of an issue of shares on favourable terms sooner or later. A larger dividend is also anticipated in the market. Turner and Newall were higher at 108s. This is another company which it is generally assumed will increase its distribution. United Molasses were again active and have risen further from 27s. 3d. to 28s. 6d. Associated Portland Cement were better at 106s. in response to dividend estimates which range up to 25 per cent. Other cement shares were also more active, particularly Tunnel Cement. Rugby Portland Cement were steady on the belief that the dividend will at least be maintained and British Plaster Board at 43s. 7½d. are within a few pence of the price ruling a week ago.

Boots Pure Drug reacted from 60s. to 59s., but were again particularly active. Sangers at 27s. 1½d. have not kept best prices. Timothy Whites and Taylors remained around 33s. Borax Consolidated, which came in for moderate profit-taking following the recent dividend announcement, are now 35s. 3d. The raising of the dividend from 5 per cent. to 7½ per cent. was up to general expectations. It is payable on a larger capital, but it is being assumed that the full results are likely to show the larger dividend to be a conservative payment. A good deal of interest continued to attach to Swedish Match "B" shares, which have risen further from 21s. 6d. to 23s. Pinchin, Johnson, International Paint, and Indestructible Paint were steady, awaiting next month's dividend announcements. Distillers were virtually unchanged at 117s. 9d. Triplex Safety Glass continued to show active business. British Oil and Cake Mills preferred ordinary again received a good deal of attention, pending publication of the results and United Premier Oil and Cake ordinary were also active. The latter at 11s. 1½d. are within 3s. of the price ruling a week ago.

Calico Printers, Bradford Dyers and the ordinary units of the other big textile combines were active but best prices were not held.

Consett Iron have been in good demand on any reaction in price. The next report will be the first to reflect the reconstruction of the capital, and, as it is assumed the upward movement in profits has been accelerated, there are expectations of dividends being resumed with a favourable payment. Richard Thomas were steadier on the success of the new share issue and United Steel Companies ordinary were again in demand at rather higher prices. "Shell" and other leading oil shares were again active, and on balance prices have advanced further despite a moderate reaction shown later in the week.

Weekly Prices of British Chemical Products

THERE are no important price changes to report in the London markets for general chemicals, wood distillation products, pharmaceutical and photographic chemicals, perfumery chemicals, essential oils and intermediates. Among rubber chemicals there have been increases in the prices of cadmium sulphide and lithopone. In the coal tar products section the prices of all grades of benzol are ½d. per gal. lower than a week ago, while pyridine 90/140 is slightly dearer.

MANCHESTER.—A fair amount of interest has been displayed in chemicals on the Manchester market during the past week. The volume of new business booked since last report has been moderate, much of it composed of orders for spot lots and for near delivery positions, with a sprinkling of contracts extending over the next few months. Textile chemicals are in somewhat improved demand both in this area and in the West Yorkshire centres, and good contract deliveries of other descriptions of heavy products have also been reported. Prices generally are on a steady basis, with here and there a stiffening tendency in evidence. The pitch section of the by-products market is about maintained at the slightly improved level indicated a week ago, and a little speculative buying interest is reported. Cresylic acid and pyridine are both on a distinctly firm price basis and offers for early delivery are in each case scarce.

GLASGOW.—Charles Tennant and Co., Ltd., report that business remains quiet in the Scottish heavy chemical market with no price changes to record. According to Bryce and Rumpff there has been a steady day to day demand for chemicals for home trade during the week, though export business has been rather quiet. Prices generally continue very firm at about previous figures with no important changes to report. Our own coal tar products market reporter states that there is a strong demand for most of the lighter materials of the coal tar products group. Trading in some of these products, however, is definitely hampered by a shortage of supplies for early delivery. Numerous inquiries for cresylic acid are being turned down by manufacturers. Any available parcels are commanding peak prices, and a further advance seems likely. Values of high tar acid oils are rising in sympathy, while other oils are firm in line with B.S.I. creosote. Crude and motor benzol are moving well against existing contracts. The pitch market seems a little brighter, but there are still large stocks showing little movement.

General Chemicals

ACETONE.—£45 to £47 per ton.

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £30 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, in 1-cwt. bags, £28; powdered, in 1-cwt. bags, £29.

ACID, CHROMIC.—9¼d. per lb., less 2½%; d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 11¾d. SCOTLAND: B.P. crystals, 1s. per lb., less 5%.

ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50: pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

ACID, SULPHURIC.—168° Tw., £4 5s. to £4 15s. per ton; 140° Tw., arsenic-free, £2 15s. to £3 5s.; 140° Tw., arsenious, £2 10s.

ACID, TARTARIC.—11¾d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 11¾d. to 1s. per lb.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINIUM SULPHATE.—£7 per ton d/d Lancs.; GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £16 10s. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—£55 10s. per ton.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish £17 10s. ex store.

BARIUM CHLORIDE.—£10 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9.

BORAX COMMERCIAL.—Granulated, £14 10s. per ton; crystal £15 10s.; powdered, £16; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £14 10s. per ton in 1-cwt. bags, carriage paid.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. GLASGOW: 70/75% solid, £5 10s. per ton net ex store.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £19 10s. per ton d/d

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. GLASGOW: £3 19s. net.

FORMALDEHYDE.—£22 10s. per ton.

GLYCERINE.—Chemically pure, double distilled, 1,260 s.g., in tins, £4 17s. 6d. to £5 17s. 6d. per cwt. according to quantity; in drums, £4 10s. to £5 3s. 6d.

IODINE.—Resublimed B.P., 5s. 1d. per lb.

LEAD ACETATE.—LONDON: White, £35 10s. per ton; brown, £35. GLASGOW: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36, brown, £35.

LEAD NITRATE.—£39 per ton.

LEAD, RED.—SCOTLAND: £40 per ton less 2½%, carriage paid, for 2-ton lots.

LEAD (WHITE, SUGAR OF).GLASGOW: £35 per ton, carriage paid.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O P., 1s. 9d. to 2s. 4d.

PARAFFIN WAX.—SCOTLAND: 3⅜d. per lb.

PHENOL.—6⅜d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39 10s.

POTASSIUM BICHROMATE.—SCOTLAND: 5d. per lb., less 5%, carriage paid.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4½d. per lb. MANCHESTER: £38 per ton.

POTASSIUM IODIDE.—B.P. 4s. 3d. per lb.

POTASSIUM NITRATE.—£27 per ton. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¾d. per lb. SCOTLAND: B.P. Crystals, 9¾d. MANCHESTER: B.P. 10¾d. to 11¼d.

POTASSIUM PRUSSATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d. to 6¾d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. GLASGOW: Large crystals, in casks, £38.

SALT CAKE.—Unground, spot, £3 16s. 6d. per ton.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£18 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. GLASGOW: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. MANCHESTER: 4d. per lb. GLASGOW: 4d., less 5% carriage paid.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags.

SODIUM CHLORATE.—£26 10s. to £30 per ton. GLASGOW: £1 10s. per cwt.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM HYPOSULPHATE.—Commercial, 2 ton lots d/d, £10 5s. per ton; photographic, £14 5s. MANCHESTER: Commercial, £10; photographic, £14 10s.

SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.

SODIUM NITRATE.—Refined, £7 15s. per ton for 6-ton lots d/d.

SODIUM NITRITE.—£18 5s. per ton for ton lots.

SODIUM PERBORATE.—10%, 9¼d. per lb. d/d in 1-cwt. drums.

SODIUM PHOSPHATE.—£13 per ton.

SODIUM PRUSSIATE.—4d. per lb. for ton lots. GLASGOW: 5d. to 5¾d. ex store. MANCHESTER: 4¼d. to 4½d.

SODIUM SILICATE.—£9 10s. per ton.

SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 5s.

SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SODIUM SULPHITE.—Pea crystals, spot, £13 5s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

SULPHATE OF COPPER.—£20 per ton, less 2%, in casks. MANCHESTER: £20 10s. per ton f.o.b. SCOTLAND: £21 per ton less 5%, Liverpool, in casks.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

ZINK SULPHATE.—Crystals, £9 per ton, f.o.r., in bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb., according to quality. Crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARYTES.—£6 to £7 10s. per ton, according to quality.

CADMIUM SULPHIDE.—5s. 3d. to 5s. 6d. per lb.

CARBON BISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.

CARBON BLACK.—3 11/16d. to 4 13/16d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.

CHROMIUM OXIDE.—Green, 1s. 2d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

INDIA-RUBBER SUBSTITUTES.—White, 4½d. to 5d. per lb.; dark, 3¾d. to 4¼d. per lb.

LAMP BLACK.—£22 to £23 per ton.

LEAD HYPOSULPHITE.—9d. per lb.

LITHOPONE.—30%, £16 10s. to £17 5s. per ton.

SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.

VERMILION.—Pale, or deep, 5s. per lb., 1-cwt. lots.

ZINC SULPHIDE.—10d. to 11d. per lb., according to quality.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Neutral quality, basis 20.6 per cent. nitrogen, delivered in 6-ton lots to farmer's nearest station, February, £7 3s. 6d. per ton; March to June, £7 5s. per ton.

CALCIUM CYANAMIDE.—February, £7 2s. 6d. per ton; March, £7 3s. 9d. per ton; April to June, £7 5s. per ton, carriage paid to any railway station in Great Britain in lots of four tons and over.

NITRO-CHALK.—£7 5s. per ton for delivery to end of June.

NITRATE OF SODA.—£7 12s. 6d. per ton for delivery up to end of June.

CONCENTRATED COMPLETE FERTILISERS.—£10 12s. to £11 1s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.

AMMONIUM PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 3s. 3d. to 3s. 4d. per gal.; 99/100%, 3s. 8d. to 4s. 6d. per gal., according to specification; pale 99%, 3s. 5d. to 3s. 6d.; dark, 2s. 10d. to 3s. GLASGOW: Pale, 99/100%, 3s. 3d. to 3s. 9d. per gal.; pale, 97/99%, 3s. to 3s. 4d., dark, 97/99%, 2s. 6d. to 2s. 9d.; high boiling acids, 1s. 10d. to 2s.; American specification, 2s. 9d. to 3s. 3d. MANCHESTER: Pale, 99/100%, 3s. 9d.

ACID, CARBOLIC.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 2s. 7d. to 2s. 9d. per gal. MANCHESTER: Crystals, 6¾d. to 7d. per lb.; crude, 2s. 8d. per gal. GLASGOW: Crude, 60's, 2s. 6d. to 2s. 9d. per gal.; distilled, 60's, 2s. 9d. to 3s. 3d.

BENZOL.—At works, crude, 9d. to 9½d. per gal.; standard motor 1s. 2½d. to 1s. 3d.; 90%, 1s. 3½d. to 1s. 4d.; pure, 1s. 7½d. to 1s. 8d. LONDON: Motor, 1s. 3½d. GLASGOW: Crude, 9d. to 10d. per gal.; motor, 1s. 2½d. to 1s. 3½d.

CREOSOTE.—B.S.I. Specification standard, 5¼d. to 6d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North: 5d. London. MANCHESTER: 5½d. to 6d. GLASGOW: B.S.I. Specification 5½d. to 5¾d. per gal.; washed oil, 4¾d. to 5¼d.; lower sp. gr. oils, 5d. to 5½d.

NAPHTHA.—Solvent, 90/160%, 1s. 6½d. to 1s. 7½d. per gal.; 95/160%, 1s. 7d.; 90/190%, 1s. 1d. to 1s. 2½d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 6d. to 6¾d. per gal.; 90% 160, 1s. 4d. to 1s. 5d. 90% 190, 1s. to 1s. 1d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £11 10s. to £12 10s. per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free).

PYRIDINE.—90/140%, 9s. to 9s. 6d. per gal.; 90/180, 2s. 6d. to 3s. GLASGOW: 90% 140, 9s. to 10s. per gal.; 90% 160, 7s. to 8s.; 90% 180, 2s. 6d.

TOLUOLE.—90%, 2s. per gal.; pure, 2s. 5d. GLASGOW: 90%, 120, 1s. 10d. to 1s. 11d. per gal.

PITCH.—Medium, soft, 34s. to 35s. per ton, in bulk at makers' works. MANCHESTER: 34s. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 28s. 6d. to 35s. per ton; in bulk for home trade, 32s. 6d.

XYLOL.—Commercial, 2s. 1d. per gal.; pure, 2s. 3d. GLASGOW: Commercial, 1s. 11d. to 2s. per gal.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 10s. to £9 per ton; grey, £10 10s. to £11. Liquor, brown, 30° Tw., 6d. to 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11 10s.

CHARCOAL.—£5 5s. to £10 per ton, according to grade and locality.

METHYL ACETONE.—40-50%, £43 to £46 per ton.

WOOD CREOSOTE.—Unrefined 6d. to 9d. per gal., according to boiling range.

WOOD, NAPHTHA, MISCIBLE.—2s. 6d. to 3s. 3d. per gal.; solvent, 3s. 3d. to 3s. 6d. per gal.

WOOD TAR.—£2 to £3 per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.

m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.

o-CRESEL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.

p-CRESOL 34-5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.

DICHLORANILINE.—2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—7½d. per lb.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 10d.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—In bags, £88 15s. per ton; in casks, £89 15s.

α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works in casks.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.

o-TOLUIDINE.—10½d. per lb., in 8/10-cwt. drums, drums extra.

p-TOLUIDINE.—1s. 10½d. per lb., in casks.

m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, Feb. 10.—LINSEED OIL was steady. Spot, £29 10s. per ton (small quantities); Feb., £27; March-April, £27 2s. 6d.; May-Aug., £27 5s.; Sept.-Dec., £27 7s. 6d., naked. SOYA BEAN OIL was steady. Oriental (bulk), afloat, Rotterdam, £28 5s. per ton. RAPE OIL was inactive. Crude extracted, £35 10s. per ton; technical refined, £36 10s., naked, ex wharf. COTTON OIL was easy. Egyptian crude, £30 per ton; refined common edible, £33; deodorised, £35, naked, ex mill (small lots £1 10s. extra). TURPENTINE was quiet. American spot, 41s. per cwt.

HULL.—LINSEED OIL, spot, quoted £27 7s. 6d. per ton; Feb. and March-April, £26 17s. 6d.; May-Aug., £27; Sept.-Dec., £27 2s. 6d. COTTON OIL, Egyptian, crude, spot, £29 10s.; edible, refined, spot, £32 10s.; technical, spot, £32 10s.; deodorised, £34 10s., naked. PALM KERNEL OIL, crude, f.m.q., spot, £32 10s. naked. GROUNDNUT OIL, extracted, spot, £33 10s.; deodorised, £36 10s. RAPE OIL, extracted, spot, £34 10s.; refined, £35 10s. SOYA OIL, extracted, spot, £34; deodorised, £36 per ton. COD OIL, f.o.r. or f.a.s., 27s. 6d. per cwt. in barrels. CASTOR OIL, pharmaceutical, 45s.; first, 40s.; second, 38s. TURPENTINE, American, spot, 43s. 6d. per cwt.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

EAST RIDING CHEMICAL CO., LTD., Hull. (M., 13/2/37.) January 22, £2,000 and £1,000 mortgages (sec. 81, 1929 Act) and £1,000 mortgage and further charge, to A. S. Wilson, London, and another, H. H. Butterfield, Chalmont St. Peter, and the same; charged on lands and buildings at Hull. *Nil. October 11, 1935.

Bill of Sale

MURRAY, HUMPHREY DESMOND, 9 Elm Place, South Kensington, consulting chemist and director of a company. (B.S., 13/2/37.) Dated February 1. Filed February 5. £50 0s. 0d.

Receiverships

MIDWAY CHEMICAL CO., LTD., Slough. H. W. Payne, of 209-211, Abbey House, Victoria Street, S.W.1, was appointed receiver and manager on January 28, 1937, under powers contained in debentures dated October 19, 1936.

VOXOL PRODUCTS CO. (1919), LTD., tallow, grease and oil refiners, fertiliser manufacturers, etc., 8 North John Street, Liverpool. (R., 13/2/37.) R. F. Leather, of "The Dell," Beechwood Road, Grassendale, Liverpool, ceased to act as receiver and/or manager on January 22, 1937, and A. L. Jones, of 10 Rumford Place, Liverpool, was appointed receiver and manager on the same date, under powers contained in second debenture dated April 14, 1920.

Forthcoming Events

LONDON.

Feb. 15, 17 and 18.—University of London. Special University Lectures in Mining and Metallurgy. "The Structure of Alloys." Professor W. L. Bragg. 5.30 p.m. Physics Theatre, Imperial College, Royal College of Science, South Kensington, London.

Feb. 16.—British Association of Refrigeration. Symposium on "Bacteria in Frozen Vegetables; Moulds in Timber." 6.30 p.m. British Industries House Club, Marble Arch, London.

Feb. 16.—Society of Chemical Industry (Plastics Group). "Casein Materials as Applied to Plastics." Robert Dodd. 7.30 p.m. Rooms of the Chemical Society, Burlington House, Piccadilly, London.

Feb. 17.—Institution of Chemical Engineers. "Chemical Methods of Treating Sewage: British Practice." J. H. Garner. "Modern Chemical Treatment of Sewage in the United States of America." Harry H. Hendon. "Chemical Treatment of Sewage in Germany." Dr.-Ing. Karl Imhoff. 5.15 p.m. Rooms of the Chemical Society, Burlington House, Piccadilly, London.

Feb. 17.—Institute of Chemistry (London and South Eastern Counties Section). "The Past and Future of the Institute." Professor J. F. Thorpe. 7.30 p.m. 30 Russell Square, London.

Feb. 18.—Chemical Society. Ordinary Scientific Meeting. 8 p.m. Burlington House, Piccadilly, London.

Feb. 19.—Institute of Fuel. Informal Discussion on "Can an Increase in the present Coal Prices be justified in the National Interest"? opened by Aneurin Bevan, M.P., and E. C. Evans. 6.30 p.m. Gatti's Restaurant, 436 Strand, London.

BIRMINGHAM.

Feb. 18.—Institute of Vitreous Enamellers. (Midland Section). "A resume of Some Studies on Sheet Ground Coat Enamels." Professor R. M. King (read by A. R. Edwards). 7.30 p.m. Chamber of Commerce, New Street, Birmingham.

Feb. 19.—Institute of Metals. (Birmingham Section). "Non-Ferrous Welding." H. G. W. Hignett. 7 p.m. James Watt Memorial Institute, Birmingham.

Feb. 19.—Institute of the Plastics Industry. (Birmingham Section). Dance. Tony's (Majestic) Ballroom, Birmingham.

BRISTOL.

Feb. 18.—Institute of Chemistry (Bristol and South West Counties Section). "Water Supplies." R. H. Ellis. 5.30 p.m. Chemical Department of the University, Woodland Road, Bristol.

GLASGOW.

Feb. 19.—Chemical Society and Society of Chemical Industry (Glasgow Sections). "Ionic Migration." Professor J. Kendall. 7.30 p.m. Royal Technical College, Glasgow.

HULL.

Feb. 15.—Hull Chemical and Engineering Society. "The Formation of a Viscose Thread." A. P. Backshell and F. A. Parish. 7.45 p.m. Room 57, Municipal Technical College, Park Street, Hull.

LEEDS.

Feb. 15.—Institute of Chemistry. (Leeds Section). "Scientific Food Preparation." L. H. Lampitt. Leeds.

MANCHESTER.

Feb. 15.—Institution of the Rubber Industry. (Manchester Section). "The Oxidation of Rubber." Dr. van Rossem. Constitutional Club, St. Ann's Street, Manchester.

Feb. 16.—Chemical Society (Manchester Section) and Manchester University Chemical Society. "The Biochemical Rôle of the Vitamin B Complex." Professor R. A. Peters. 4.30 p.m. Chemistry Lecture Theatre, The University, Manchester.

Feb. 17.—Institution of Petroleum Technologists (Northern Branch) and Institute of Fuel (North-Western Section). "Engine Testing." H. R. Ricardo. 7 p.m. Constitutional Club, St. Ann's Street, Manchester.

Feb. 19.—Society of Dyers and Colourists. (Manchester Section). "*p*H Control in Textile Works Practice." John Muir. 7 p.m. Constitutional Club, St. Ann's Street, Manchester.

NEWCASTLE-UPON-TYNE.

Feb. 19.—Institute of Chemistry and Society of Chemical Industry (Newcastle-upon-Tyne Sections). Lecture by Dr. L. A. Jordan. Newcastle-upon-Tyne.

SHEFFIELD.

Feb. 16.—Society of Glass Technology. Refractories Committee 4.45 p.m. Furnace Committee 6 p.m. Dinner 7 p.m. Glass Standards Committee 8.15 p.m. King's Head Hotel, Sheffield.

Feb. 17.—Society of Glass Technology. Council Meeting 10 a.m. Luncheon 12.30 p.m. King's Head Hotel, Sheffield. Ordinary General Meeting 2 p.m. Department of Science, The University, St. George's Square, Sheffield.

Feb. 19.—Chemical Society. (Sheffield Section). "The Unravelling of Complex Reactions." Professor H. M. Dawson. 5.30 p.m. Chemistry Lecture Theatre, The University, Sheffield.

New Chemical Trade Marks

Compiled from official sources by Gee and Co., patent and trade mark agents, Staple House, 51 and 52 Chancery Lane, London, W.C.2.

Lumbasan. 561,590. Chemical substances for preserving cut timber and wooden articles against fungus attack and sap stain. British Dyestuffs Corporation Limited, Imperial Chemical House, Millbank, London, S.W.1. July 16, 1935.

Scutamol. 570,650. Chemical substances used in manufactures, photography, or philosophical research, and anti-corrosives. British Dyestuffs Corporation Limited, Imperial Chemical House, Millbank, London, S.W.1. July 30, 1936.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—A firm of manufacturers' agents, established at Karachi, wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of paints and varnishes for the provinces of Sind, Punjab, Baluchistan, North-West Frontier Province, Cutch, Kathiawar and Afghanistan. (Ref. No. 720.)

British West Indies.—A travelling representative established in the Virgin Islands wishes to obtain the representation, on a commission basis, for the Virgin, Leeward and Windward group of islands of United Kingdom oil refiners and manufacturers of lard compound, patent medicines and drugs and proprietary lines of any nature. (Ref. No. 721.)

Egypt.—A reputable firm of general commission agents in Alexandria wish to represent United Kingdom manufacturers of pharmaceutical products. (Ref. No. 737.)

Siam.—The British Consul-General at Bangkok reports that the Department of the Royal State Railways of Siam is calling for tenders (Private Tender No. P.391) for the supply and delivery of 1,000 tins (of 7 lbs. each) of light stone ready mixed paint suitable for tropical climate. A sample must be submitted. Tenders endorsed "Tender for Light Stone Ready Mixed Paint" and samples should be addressed to the Superintendent of Stores, Central Office of Stores, Royal State Railways of Siam, Bangkok, Siam, by whom they will be received up to noon on March 19, 1937. (Ref. T.135.)